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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS,
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 32.

Contents and Index to Advertisers, Page 12.

GISHOLT

If you are making parts of your machines in duplicate and in fair quantities of a kind at a time, investigate the merits of a GISHOLT LATHE and find out what a very great saving can be made by the use of this machine.

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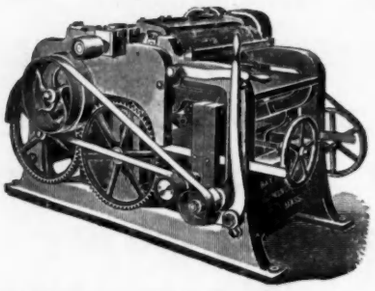

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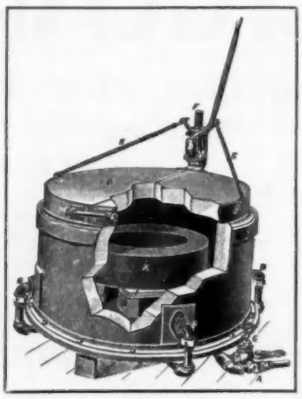

The illustration shows a circular block, K, resting upon fire-brick supports, H, which are so placed that they do not in any way obstruct the flames emitted from the four burners, B. The direction of the flame is tangential at the proper angle, to secure a rotary or whirling motion of the flame and the even distribution of the heat, perfectly and evenly heating the work. If your work is of a different character, as to size and shape, you'll probably find by looking through our big, illustrated catalog, that we have already anticipated your needs and have provided a machine that's exactly suited to your requirements. The catalog is free, and we would be glad to send you a copy.

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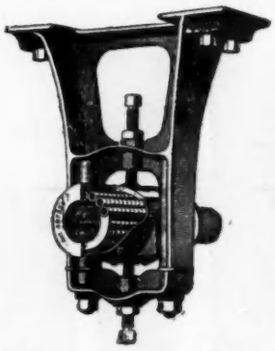

"Saving at the Spigot and Losing at the Bung."

When purchasing a large quantity of machinery, some buyers think it shrewd to lump all of their purchases, and by swelling the total amount, obtain the not unusual lower total price.

The long headed man selects the best article of each kind and says: "Let every tub stand on its own bottom." Hyatt Bearings stand on their own merits.

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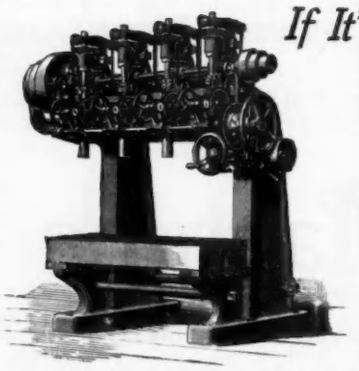

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two, four, six or eight holes at a time—holes up to 2½ inches in diameter, through steel or other hard metal—you'll find the answer in our Multiple Drills.

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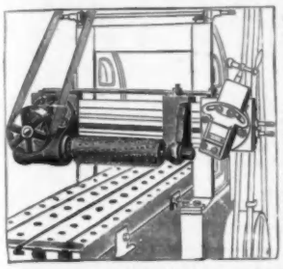

combined with any **Iron Planer** swivels from Horizontal to Vertical. Do not plane surfaces that should be milled or mill surfaces that should be planed.

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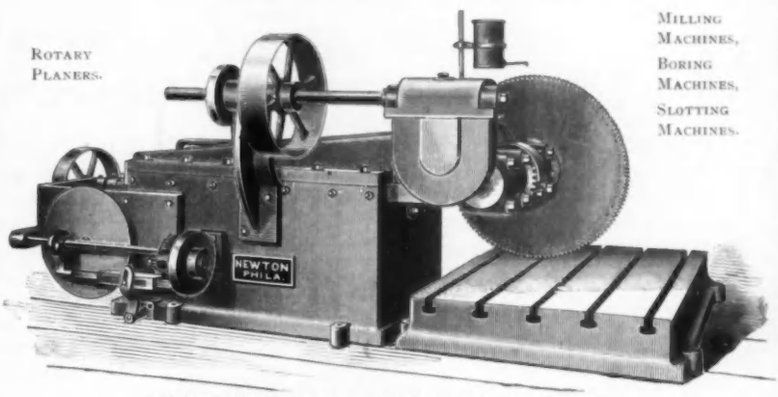

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124-126 First Avenue,
.....Pittsburgh, Pa.

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Opposing a Labor-Saving Device.

The fact that the Torrens law recently put in force in the state of Illinois is being strongly opposed by lawyers whose business it is to search titles, and by companies who guarantee such titles, is very significant when considered in connection with what has taken place many times in all parts of the world upon the attempt to introduce labor-saving machinery. The law referred to simplifies the operation of selling and buying land, tends to make land titles more secure and lessen the amount of legal services required in transferring title. In other words, it is a labor-saving device; not made of iron and steel nor intended to supplant muscles, but in the form of a statute, and intended to economize brain labor, i. e., lawyers' brain labor. Do the lawyers recognize this as a step in the world's progress, somewhat inconvenient to them just now perhaps, and detrimental to their immediate interests, but yet to be welcomed as for the general good and in the interest of the "greatest good to the greatest number"? Do they remember all the things they have been saying of those who in industrial establishments "foolishly and blindly" (as we ourselves believe) have opposed the introduction of labor-saving machinery? Not at all. They throw all that to the winds, look only at the immediate effect upon the contents of their strong boxes, and by all sorts of obstructive tactics, put themselves in the ranks of the "blinded and ignorant mobs" who fail to see that the world must progress and that the immediate selfish interest of the individual must not be allowed to stand in the way of that progress.

Opposition to department stores by retail merchants, and opposition to large aggregations of capital by clerks, managers, and traveling salesmen displaced by such combinations, all springs from precisely the same source, and it does not lie in the mouths of any of these people to say a word against workingmen for opposing the use of labor-saving machinery; bad and unwise as we believe such opposition to be.

The French Tariff on Machinery.

Though at this writing we are not informed as to particulars we believe that an understanding has been arrived at between ours and the French government by which, in return for certain advantages given them, they admit certain forms of American machinery at a lower rate of tariff than has heretofore been placed upon it It is announced, however, that M. Meline, who is out of office at present because he was the Premier who was chiefly responsible for the Dreyfus disgrace, has declared war against this arrangement with the American government because it admits American food stuffs on more favorable terms, whereas he, as the representative of the large land-holding classes of France, imagines it to be to the interest of that class that the French workman's food should be enhanced in price in order that rents of farming lands may be higher. Thus we see that our machinery interests are more or less involved with a question which is likely to be settled one way or the other, without the least reference to the interests of machinery builders, or users as such.

It is to be hoped at least that the discrimination against the smaller and lighter machine tools, the principal advocate and beneficiary of which is Barriquand, of Paris, will be done away with. No other country in Europe levies a higher tariff upon machinery weighing below a certain amount; American machine tools being imported into France, for instance, against a tariff of $60 per metric ton (about 2,000 lbs.), if they weigh under one-quarter ton, while if over one-quarter ton, the duty is only $36 per ton.

Some Variant Industrial Conditions.

After about two months spent in studying shop methods and work as carried on here, Mr. Janssens, of Paris, who is familiar not only with Continental but with British shop practice as well, expresses it as his conviction that shop methods on the other side must be very radically changed before they can compete with us on even terms, and he seems not to be very sanguine as to the prospect of such a change taking place.

He says, for instance, that in France there is not nearly so good a chance as here for a young man to go into business with small capital and build up a success. The practice of the banks there, the systems of credit and commercial usages are all against him and in favor of the establishment that is well established and can command capital. This discourages initiative on the part of young men, not only as regards going into business for themselves, but it prevents them also from being as efficient employees as they would be if they knew there was a possibility of a future successful career before them.

The "Code Napoleon" Mr. Janssens spoke of as being especially detrimental to the development of large and successful industrial enterprises in France. This law gives a business man who is married absolute control of only one-fourth of his capital, one-half of it being tied up by his wife's interest and one-fourth of it by his children's interest. This often operates to prevent a man having a free hand in commercial or industrial enterprises, and although this difficulty can be avoided by the formation of joint stock companies, this is very expensive in France.

Here it seems to Mr. Janssens that our laws and customs are all better calculated to develop individuality and individual enterprise, and this stimulating influence extends all through our industrial system.

The closest observers and those who have had the best opportunities for observation are practically agreed that the matter of European workshops competing successfully with our own goes much deeper than the mere installment of our tools over there and their use in production. Men to operate these tools and keep them "tuned up to concert pitch," as

we sometimes say, must be obtained, and not only does this mean operatives and mechanics with new ideas and a willingness to adopt still newer ones, but it also means employers with new ideas.

It has been found, for instance, that in very many cases British and Continental shop owners have been shocked at the idea of paying American mechanics, say $25 a week, to look after a lot of improved tools and keep them up to their maximum rate of production, and in some cases where they have at first agreed to do this they have soon quit it, assigning therefor various reasons, but usually that their other employees got to know of it and that it demoralized their whole shop organization. Probably the true reason is that the "tool maker" as we have developed him here in America is practically unknown elsewhere and equally unappreciated. The European mechanic, for the most part, expects to occupy all his life the position in which he starts out. His employer expects him to do so, and each treats the other accordingly. This must be changed before competition can be on even terms, and before it can be changed much must be done in the way of abolishing old social customs and laws and enacting new ones. This is not likely to be done in the twinkling of an eye.

Low Water Makes an Engine Run Backwards.

A friend living at Schenectady sends a clipping from the "Press," of this city, which clipping is as follows:

"Passengers on a Long Island train going from Wreck Lead to Lynbrook had an exciting ride yesterday afternoon, with the boiler of the locomotive threatening to explode the entire way. The train left Long Beach, on the East Rockaway branch, on time, and after the stop at the next station, Wreck Lead, the engine refused to move. A hasty investigation showed that the inspirator, which forces the water into the boiler, was not working, and while steam was rapidly generating, no more water was going in. All the train hands turned to, trying to repair the pipes, and the fireman stood ready to dump the fire the instant the water gage registered lowest ebb.

"By dint of hard work and extra water carried in buckets and forced into the pipes, it was declared after half an hour that the engine could get to Lynbrook, the end of the branch. With the inspirator still useless, the train started, while the fireman kept his post, not to stoke, but to 'kill' the engine in a moment.

"A necessary stop at East Rockaway brought fresh trouble and greater anxiety, for the engine when started would only go backward. More water was poured in, and finally it started. The next five miles were covered at a snail's pace, and with imminent danger of the boiler's exploding."

Enginemen will henceforth know that when they run short of water there will be danger of the engine running backwards, and when it does, the only remedy is to get more water into it in some way. They already know that newspaper reporters will believe and print anything they are told about an accident.

Some Cornell Work and Its Value.

"The first year's work in Cornell's unique hydraulic laboratory has been marked by the completion of an important investigation, for the United States Deep Waterways Commission, of the flow of water over dams of various contours. Nothing was known of this, heretofore, and the resulting information enabled the Commission to reduce their estimates for a ship canal from the lakes to the Atlantic by $10,000,000 or so in a single item, the feeder to the Rome summit. Cornell is in a way to save Uncle Sam more than he has given her."

The above item was, we assume, written by a Cornell undergraduate. When he goes out into the world he will probably realize much more fully than he does now that the value of services and the compensation for them are not based upon what may be saved or made by means of such devices, but by what other persons are ready to render similar services for. The captain of a ship by letting go his anchor at just the right time may save the ship and her cargo; but he works for a small salary, because others are ready to take his place if he quits.

From an English newspaper we gather the following regarding the trial of a new 6-inch quick-firing gun and mounting, made by Messrs. Vickers, Sons & Maxim, Limited, for the United States Government: "Full charges of cordite were fired, when a velocity of 2,837 feet per second was obtained for a working pressure of 17 tons. The striking energy of the gun was no less than 5,724 foot-tons, and calculated to perforate a thickness of steel armor of 17 inches. The construction of these guns permits great ease in adjustment. The energy of the recoil is absorbed by a small hydraulic cylinder in combination with two springs, which latter, after firing return the gun to firing position. The novel features in the gun are the high energies and great rapidity of firing obtained from a gun in which the charge is not contained in a metallic case." The United States Government recently purchased the rights of manufacture for their navy of the Vickers quick-firing mechanism and breech screw.

The report of a special committee appointed under the auspices of the Ministry for Commerce and Manufactures of Russia, to consider the question of a system of weights and measures for the empire has been drawn up. The committee of which Profs. Mendelejeff and Kanowaloff have been prominent members, recommend that the metric system be introduced gradually, and in commerce only when both parties to the transaction agree to employ it. Alterations are to be made in the measures of area and volume for certain articles, and also in the apothecaries' weights. Quite an elaborate system to supervise the weights and measures of the empire is proposed, with a main office at St. Petersburg, and "control institutes" in different cities. These will be founded gradually, and by the year 1920 it is proposed that there shall be 100 of such bureaus.

Mr. Ralph N. Blakeslee, of Waterbury, Conn., has built a truck specially adapted for conveying machinery about the city, which truck is said to be capable of carrying a weight of fully 75 tons. The truck itself weighs 5 tons, and is intended to be drawn by 12, 24 or 36 horses. An interesting thing about it is, that the four wheels which together weigh three thousand pounds, are in part made of castings which were made for the wheels of a confederate gun carriage, but being made shortly before the end of the war of the rebellion were never delivered. The tires of these wheels are 8 inches wide, 1½ inches thick, and were put in place by workmen at the Taunton Locomotive Works.

The number of locomotives exported during the fiscal year just ended was 517 against 468 in 1898, 338 in 1897, 261 in 1896, 252 in 1895, and 142 in 1894, while the value of the exports of locomotives in 1899 was $4,728,748 against $1,028,236 in 1894. Of the 517 locomotives exported during the year, 99 went to Russia, 69 to Japan, 61 to China, 59 to Mexico, 50 to Canada, 36 to British East Indies, 25 to England, 23 to Norway and Sweden, 20 to Brazil, 14 to the West Indies, and 11 to Africa. It is interesting to note that of this number of locomotives exported in 1899, 211 went to Asiatic countries.

An English friend writes us, "Among real active engineers here I have not heard a word of surprise or fear with regard to the recent orders for locomotives placed in the States. It is mostly the non-technical public and papers who have made the fuss."

Recently two automobiles beat an express train traveling between Paris and St. Malo, France, a distance of 226 miles. The automobiles covered the distance in 7 hours 35 minutes, while the time of the train was 7 hours 48 minutes.

It is announced that at the automibile races held at Suresnes, France, those vehicles which had been built in America won every prize.

Commercial Review.

NEW YORK, MONDAY EVENING, August 7, 1899.

MACHINE TOOLS.

The little effect that hot weather has had upon the machine-tool trade this year is phenomenal. After weighing reports received from many different sources we are strongly inclined to say that activity is greater now than at any previous time this year, which means, of course, greater than at any time since 1892, or, perhaps, in the entire history of the tool business. A reliable method of gaging the amount of work on hand in shops is to investigate deliveries. The various dealers in New York represent and purchase from a great many different tool factories, East and West, with whom they are in constant communication, and thus one can take a pretty broad survey of the field without having to go very far for a point of view. The trend of report indicates that deliveries are growing longer, rather than shorter. In particular cases there may be a little relief, as, for instance, in upright drills in one quarter. But these cases are exceptional. Some manufacturers are taking on new orders when they already have more than they can attend to, thereby rendering it inevitable that they break their shipment agreements and their customers' hearts. Other builders come out squarely, acknowledge that their earliest deliveries are hopelessly indefinite, and are willing to turn down orders rather than undertake to accomplish impossibilities. Big lathes and planers are as rare as hens' teeth. One dealer ordered a 78-inch lathe for a customer, on five months time for delivery, which period expires within a few days, and the lathe is not expected for two months yet. Some of the foreign buyers are less long-suffering than the domestic ones, where deliveries are not up to time, and are howling for damages because their tools are not shipped when stipulated.

Middlemen and jobbers in tools are having a hard time of it. They are constantly losing orders because the factories will not agree to fill their contracts within the necessary time, but the state of affairs is still worse where manufacturers accept the contracts and then do not live up to the terms. The dealer is thus caught in a trap, and, through no fault of his own, may incur the ill will of his customer. There is a case where just this happened in connection with a lot of tools which are two month late in delivery, although they are not such large machines that a delay like that can be palliated.

We know of one dealer who now is shrewdly drawing up the contracts for the tools he sells so that, although superficially he seems to agree to deliver them in a certain time, yet in fact he protects himself from liability to penalty in case they are not ready as soon as expected.

One of the strongest influences in holding back work in some of the tool manufactories is the crowded condition of the foundries. Where a tool builder has not a foundry of his own he may start to make arrangements to have a particular lot of castings executed for him outside, and by the end of a week, when he has received his own order so that he is sure what he wants to have done, the foundry has taken on enough additional work to keep it busy for a month. The first come to the foundry, the first served; consequently the tool builder does not get the machines completed by the time he has promised his customer.

A company in Cincinnati which constructs a single line of machine tools has a system of ordering work from its factory which it finds to give excellent results. This method is to call regularly upon its shop for such quantities of its respective sizes of machines as the stock shows from time to time to be required. Shortages in any particular size are therefore made up without waiting for the execution of contracts for tools of other sizes which may be on hand. This keeps matters running evenly, and although it may not always be *prima facie* pleasing to customers it seems to favor their interests in the long run.

Prices do not seem yet to have attained a maximum, for fresh reports of advances are cropping out here or there continually. July was utilized by some companies as a time to stand out for better monetary returns. Several Cincinnati companies have lately added to the amounts demanded. The American Tool Works Company made an advance in prices last week and is expected to make another within a few days, which increases together will amount to 10 to 15 per cent. above prices prevailing July 1.

It is generally acknowledged that the advances in prices of tools tend to prejudice European trade, but as yet no material injury is perceptible. The changed conditions in the raw material market are not appreciated on the other side as they are here, and foreign buyers are kicking like steers at the higher prices they have to pay for machines, but up to date they have taken it out in kicking and have continued to buy what they need. How long this will go on and how long the advance in prices will go on are profitable themes for conjecture.

An Eastern firm, who manufacture lathes and planers and who had already advanced prices 5 per cent., were recently asked by a New York dealer to sell a tool for delivery some time hence at that rate. The manufacturers replied that they could not do so, as they intended to advance prices further. The dealer replied advising them not to make further increase, as it would tend to injure foreign trade. Later news from the manufacturers is to the effect that, acting upon the advice of one of their firm who was in Europe, they have decided not to make the contemplated advance. Although now their margins are not very remunerative they feel that their best policy lies in holding on to the European trade, of which they may stand in need after the present boom at home has quieted down.

Several shipbuilding companies have figured prominently in the market this summer, and among them the New York Shipbuilding Company has ordered a good many tools.

The automobile industry is talked of as a coming craze, similar to what the bicycle boom was a few years back. At present it figures more prominently in newspaper reports of companies newly entering the business than upon the order books of machine-tool manufacturers. Some large contracts for this purpose have been, and will be, given out, but there is nothing as yet that reminds one of the steady drain upon tools and supplies for bicycle manufacture which characterized the market not long since.

Mr. John Brisben Walker, proprietor of the "Cosmopolitan Magazine," is to erect a 400x50-foot two-story plant for the manufacture of automobiles, near Tarrytown, N. Y., and it is rumored on the street that he has let a contract for some $40,000 worth of machine tools with a Boston firm. The American Tool Works Company, through a prominent representative, acknowledges the sale of about $50,000 worth of tools for installation at a plant in Boston, controlled by the Locomobile Company of America, in which Mr. Barber, of the Barber Asphalt Company, is interested, and also Mr. Walker. But we infer from statements at the office of the Locomobile Company that Mr. Walker's interests are now independent of the Locomobile Company, and that any purchases of recent date are his. These various reports could not be satisfactorily harmonized to-day, as Mr. Walker is in Boston and not expected back till to-morrow.

The American Tool Works Company has on hand a large contract for tools for automobile manufacture in France, which with that for Boston, above mentioned, will foot up to nearly $100,000. The tools include lathes, planers, drills, milling machines, etc.

A certain seller observes that he is now estimating on tools for as many as five new automobile factories.

The Mossberg & Granville Manufacturing Company is so busy at present that it is discouraging many new orders. Its present deliveries on large machines are five months at the earliest. The European business of the company averages about $1,000 a day.

The Brown & Sharpe Manufacturing Company will not allow the press of orders to interfere with its customary summer vacation period. Consequently

the works will be closed for two weeks, from August 19 to September 4. The office, however, will be open for business during that time.

CHICAGO MACHINERY MARKET.

Machine-tool agencies at Chicago are doing the best business within their experience. Quite a number of them report for July the largest business, not for July, but for any month of any year since they were in business. Each of the sellers so reporting has had for the month several good-sized orders, but the bulk of their trade was scattered and covered many classes of manufacture. Almost the whole business, however, has come from the larger manufacturing plants. Information agrees that the smaller machine shops are busy, but they do not seem to be buying much new machinery. The large manufacturers cannot get enough new equipment from all appearances. One selling agency says the buyers now want the best. Not a great while ago they were bargain hunters. Second-hand machines stood well in their favor. Now they discriminate between new products. That which they think is best is the only machine tool they will buy, if it is obtainable within reasonable time limits. Not unfrequently they are obliged to take what they can find. It is the best known makes of tools that are sold farthest into the future. The builders are not gaining on their orders. For some lines of tools shipments cannot be made within from four to seven months. But, as one representative remarks, the builders are now more careful in their promises than they had been. Not a great while ago when a machine was promised in three months it was sometimes six or seven before the machine was shipped. Now when the delivery is promised in three months it arrives at the expiration of that period. From which it may be inferred that the makers have their trade a little better in hand. The growing regard of buyers for the best has this explanation also. The unusual activity in tools first came from the East and from abroad. Prices were raised before the West was quite ready for the advance. This threw trade more largely than usual to the less known tools, on account of the better terms their makers offered.

Quite a line of tools is going out into the mining districts of the Rocky Mountain region. The big agricultural implement works are continual buyers. Automobile plants maintain their lately acquired prominence. The combination of bicycle manufacturers has flattened out that trade into an unrecognizable form. For the machinery trade at large inquiries are large and the promise of the future is cheering.

Rudolphi & Krummel were never busier than now. The Pearson Machinery Company is employing more men than at this time last year. Hill, Clarke & Co. had a better business last July by 25 per cent. than any previous month in their Chicago trade. The Marshall & Huschart Machinery Company one day last week shipped forty-seven machines to a Chicago automobile plant, the order aggregating nearly $20,000. Another day last week they sold a complete equipment for a machine shop in Wyoming. The Berlin Machine Works sold a $10,000 outfit for a Pine Bluff (Ark.) mill, and another of $14,000 for a mill in the Northwest.

ENGLISH TRADE AND AMERICAN COMPETITION.

The half-yearly engineering trades' report of Matheson & Grant, London, dated July 17, says in part: "The engineering trades were never more active and in almost all branches the products of the factories are in full demand. There is as yet hardly any sign of reaction, though the rise a few days ago in the bank rate of interest tends to show that the supply of cheap money for speculative enterprises is limited. The present condition of affairs is unprecedented, for—though there have been many previous examples of activity, and of even higher prices than those now prevailing—there has been no case during the last fifty years of so prolonged an upward movement. Higher prices are not, however, always obtainable; in some cases the manufacturer cannot get enough to recoup his higher cost of material, but there is the gain of larger output and more advantageous terms. The one-sided and onerous conditions often put forward by buyers cannot now be enforced, and those who pay promptly may be selected among a crowd of buyers. . . . . Iron and steel.—Prices which, till a year ago, had not risen in proportion to the increased activity of the engineering trades, have, since last summer and by a succession of small advances, attained their present high level, and the tendency is still upwards. While, however, this increase is obviously advantageous to the producers it is greatly limited for those who have not in their own hands, every stage in the production.

. . . . . .

"Motor cars have not come into use to the extent which was expected when the Motor cars have not come into use to the extent which was expected when the statutory restrictions to their use on the public roads were relaxed a few years ago. Cabs and other light vehicles which, in France, are propelled by engines depending for their force on volatile oil like benzoline, are here generally worked by electric storage batteries, and do not seem to compete to advantage with the smarter French carriages. For motor cars carrying merchandise through city streets, steam engines, with oil or coke fuel, appear to be the best suited. Electrical plant of all kinds is in increased demand, and the number of firms who can supply the various material for lighting and power transmission is rapidly increasing. The highest skill in design and quality of manufacture is available here as in the United States and Germany, but undoubtedly the numerous legal and official restrictions that have prevailed have impeded greatly the growth of this branch of engineering. It is to the great increase in the demand for all kinds of electric equipment that the rapid advance in the price of copper is due. . . . No report on the engineering and kindred trades is complete without frequent reference to the United States. At the beginning of this year the power of production in America was still in advance of the home demand and an export to Europe began which appeared ominous to manufacturers here. But in America, as in Great Britain, the available supply of material has been overtaken, and this restriction, together with the large requirements for railway extensions have hindered, and in some branches entirely arrested, the flow of steel and iron eastward. The evil time for British manufacturers is, however, only postponed, and the pinch of competition will be felt when, with the power of production increased on both sides of the Atlantic, there will come a struggle fatal to those who are not thoroughly equipped to meet it."

Quotations.

NEW YORK, Monday, August 7.

Iron — American pig, tidewater delivery:—

Pennsylvania irons:

No. 1 X foundry	$21 10 @ 21 60
No. 2 X foundry	20 10 @ 20 60
No. 2 plain	19 10 @ 19 60

Alabama irons for delivery in 1900:

No. 1 foundry	20 25 @ 20 75
No. 2 foundry	19 25 @ 19 75
No. 3 foundry	18 50 @ 19 00
No. 1 soft	20 25 @ 20 75
No. 2 soft	19 25 @ 19 75
Foundry forge	18 00 @ 18 50

Tool Steel — Base sizes — Standard quality, 6½ @ 8½c.; extra grades, 12 @ 14c.; special grades, 16c., and upward.

Machinery Steel—Base sizes—Ordinary brands, from store, in small lots, 2.60c.

Cold Rolled Steel Shafting—Base sizes—From store, in small lots, 3½ @ 3¾c.

Copper—Carload lots, Lake Superior ingot, 18½ @ 19c.; electrolytic, 17½ @ 17¾c.; casting copper, 17⅜ @ 17½c.

Pig Lead—Carload lots, 4.60 @ 4.65c., f. o. b., New York.

Pig Tin.—In 5 and 10 ton lots, f. o. b., 31½ @ 31¾c.

Spelter—Prime Western in carload lots, 5¾ @ 5⅞c., near future delivery at New York.

Antimony—In cask lots and over, Cookson's, 11 @ 11½c.; Hallett's, 9¾ @ 9⅞c.

Lard Oil—Prime city, present make, ice pressed, 44 @ 47c., in wholesale lots.

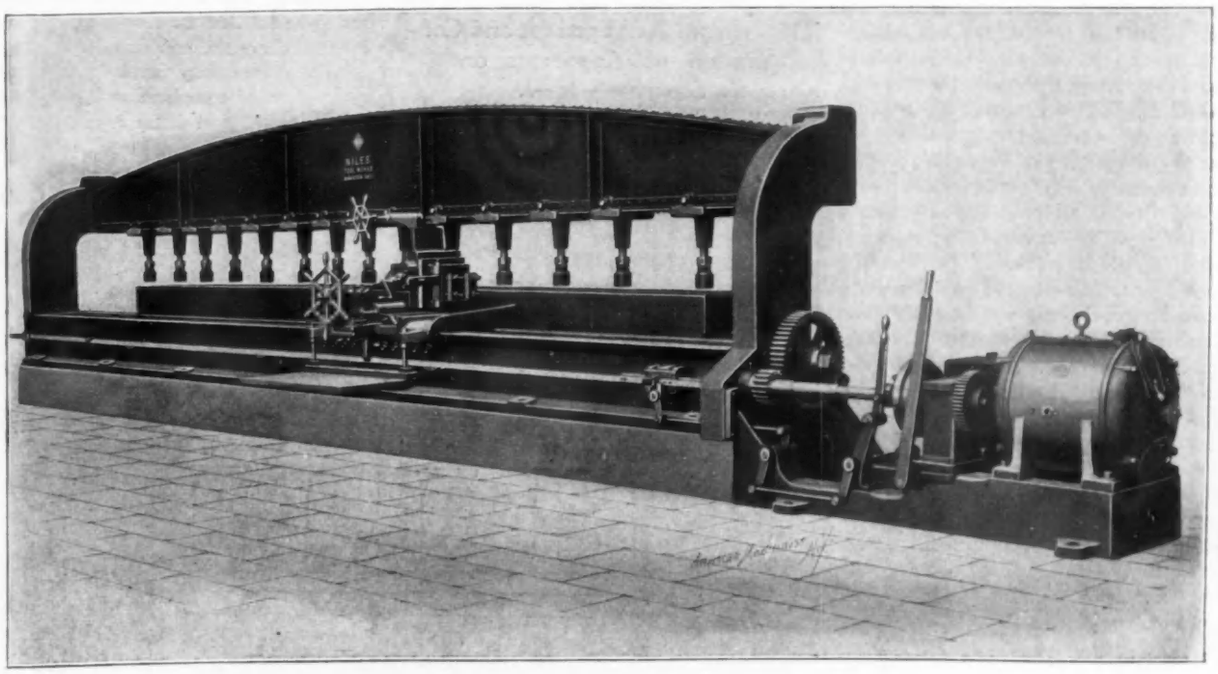
Twenty-five Foot Plate Planing Machine.

The accompanying illustration is of what may be called the latest development in plate planing machines. The machine shown is built to plane, at one setting, plates 25 feet long and any length by shifting the plate, which may be any thickness up to 2 inches. The plate is held to the bed in the usual manner by inverted jack screws, which run on rollers when shifted, and the beam which supports them is of steel plates, riveted, and is of box form.

The carriage is arranged to take a cut in either direction and carries two tools, one with a horizontal movement only and the other with both horizontal and vertical movement. The screw has a thread of 2-inch pitch, is supported in the bed its entire length, and has a ball thrust bearing at each end.

The machine is driven by an electric motor, direct-coupled to the driving mechanism. A special automatic controller is used for starting, stopping and reversing the motor and to protect it under all conditions. The motions of the carriage are governed wholly by the direction of rotation of the motor, and the power required by the motor is proportional to the work done by the machine. The operator controls the machine either at the carriage or by a lever at the motor. The performance of the motor is entirely independent of the quickness or slowness with which the lever is thrown.

On this particular machine provision was made for pulleys also, and the motor is connected to the driving mechanism by a friction clutch, so that the machine can be driven either electrically or by a belt. The machine was built by the Niles Tool Works, Hamilton, Ohio.



ELECTRICALLY-DRIVEN 25-FOOT PLATE PLANING MACHINE.

The Black Country of England—II.

TO PUMP BY ELECTRIC POWER.

In my last letter I referred to the ruin which had been wrought by careless methods of working the coal of this district. The wreckage of the surface by the abstraction of thick beds of coal is by no means the whole of the danger. On account of the severe dislocations of the surface, rainfall has been very speedily absorbed to a more than usual extent. The numerous subsidences have produced hollow places, known locally as "swags," from which there is no escape for water except by percolation. The beds of canals and streams have been disturbed and admitted large volumes of water into the coal workings, and the results have been an enormous cost for pumping and a drowning out of many mines and lower workings, so that the output has been greatly reduced. This trouble became so very serious some twenty years ago that a special act was obtained, and its provisions were administered by the South Staffordshire Mines Drainage Commissioners, who were given power to make levies *pro rata* upon all mines, for the purpose of pumping. It was very evident, however, that the greatest necessity was not to pump more water, but to pump less; and from about 36,000,000 gallons per day the output of water has been reduced to about 9,000,000, simply by repairs of the surface, the training, puddling and embanking of streams, and the pumping at the surface of the water collected in the swags to the streams. Then the pumping engines have been put in order, and brought under the control of the Commissioners, and some new ones have been added, and to-day the pumps are really ahead of their work, and could be reduced in number if only some of the pounds of water could be connected to the pumps. But some of the underground conduits have been consolidated, and water has ceased to flow to the pumps from certain of the drowned areas. The present objects of the Commission are, to open up some of the necessary underground water ways so as to drain these pounds, and to still further repair the surface and provide for the instant removal of rainfall. With a steam pump at rest it is impossible to get up steam and set the pump at work upon the product of a thunder storm until some time has elapsed. In the interval the water is going down into the workings. Many of the low-lying places have only been pumped by means of a traveling portable engine. Old quarries have been often inaccessible, and so it has come about that the cost of pumping water at the surface has been too great to allow it to be done.

It has been proposed to lay pipes and distribute power hydraulically; to lay a gas pipe and run gas engines. But both these systems present great difficulty. By the hydraulic power system it would certainly be most easy to provide an automatic arrangement whereby the hydraulically-worked pump should start up as soon as water collected in the pump, but the difficulty is rather in the pipes. The constant surface movements break gas and water pipes, and with high water pressure

the breakage might be frequent. The drowning out of the mines had become so serious that in spite of the enormous reduction in the water to be pumped, the output has diminished even in greater ratio, so as to maintain the cost of pumping at a figure as high as it was before the improvements. Matters were about at a deadlock for funds when it appeared that by means of electricity numerous small pumps could be put down at many hitherto impossible or commercially impracticable sites, so as to deal with water promptly as it fell from the clouds. For this end small centrifugal pumps of 5 or 10 horsepower, driven by electric motors from some central power station, present themselves as eminently suitable. By means of such little pumps it is proposed to pump water 5 to 20 feet into the nearest waterway, and thereby save the very much greater power necessary to pump it up perhaps 600 feet from the mines. Electrical pumps can be so very easily arranged to start automatically on the smallest rainfall, as it collects in a pump placed at the lowest point of a quarry or swag, that very much of the sudden flushes of rain storms will be promptly dealt with and lifted to stream level and sent out of the district. The conveyance of electrical energy is only a matter of poles of the cheapest and plainest type, while a combined centrifugal pump and motor is about as simple a combination as possible. Electrical energy may, it is true, be much more costly than large amounts of steam power, but the electrical pump does not require constant attention, and it deals with water by taking hold of it at lifts of possibly fifty-fold less than if it had been permitted to percolate.

Obviously the most prominent advantage is the promptitude of action which will characterize the new system. Given an old quarry or clay pit, the lowest part will be selected in which to sink, perhaps, a small receiving tank with float, and the tank will receive all the water draining to the pit bottom. The rush of water in a July thunderstorm may be sudden and copious, and the pump will automatically start up as the float rises, and it will continue to work steadily until the flush is over. It will then work at intervals as the receiver fills. In dry weather it may rest for days and will cost nothing. The promptitude of action will prevent the percolation which now takes place while steam is being got up, and the total work and cost of pumping is expected to be so much reduced that funds will soon be available for re-establishing some of the underground communications to the large steam pumps. This done, many of the steam pumps can be dispensed with and great economy effected, and the unwatering of so much drowned coal will open up now disused mines and enable the output to be increased, which in turn will reduce the tonnage rate of pumping, so that if the old output of the district could be re-established the pumping would cost less than one-fourth of what it has been doing of late, and possibly less than one-sixth. This use of electricity generated at a central station by economical machinery is an economy not because electrical energy can be so very cheaply purchased, but because so little is used. In this case energy is to be purchased from a company who are distributing electrical energy throughout the district for general purposes, and it has been suggested by myself that the manufacture of this energy should be by means of gas power, the gas used being that now going almost wholly to waste from the blast furnaces of the district. Indeed it seems there is more gas going to waste than would pump all the water of the district and dry every mine.

London. W. H. Booth.

The General Arrangement and Connection of Apparatus on Switchboards—I.

BY WM. BAXTER, JR.

In a previous article the objects of switchboards and the advantages derived from their use were set forth. In what follows, it is proposed to explain the general arrangement of the switches, instruments and other apparatus, and also to show how they are connected with each other and with the generators and the external circuits. No general rule can be given for the location of the various devices or for the circuit connections, owing to the fact that in each case the conditions are different; therefore, each particular board must be treated as an independent problem, and the disposition of the parts must be such as to best meet the particular requirements. Since no general rules can be laid down, the only course of procedure left is to present practical examples of boards that have actually been made, and by explaining the conditions they have to fulfill, throw light upon the subject that will serve to show the proper course to pursue to obtain the best results. In some cases the conditions to be fulfilled are few and easily met, while in others the conditions are numerous and of necessity involve a considerable amount of complication. If we have two generators, and desire to connect them to feed into a single system of circuits, the arrangement of the switchboard becomes a decidedly simple matter. On the

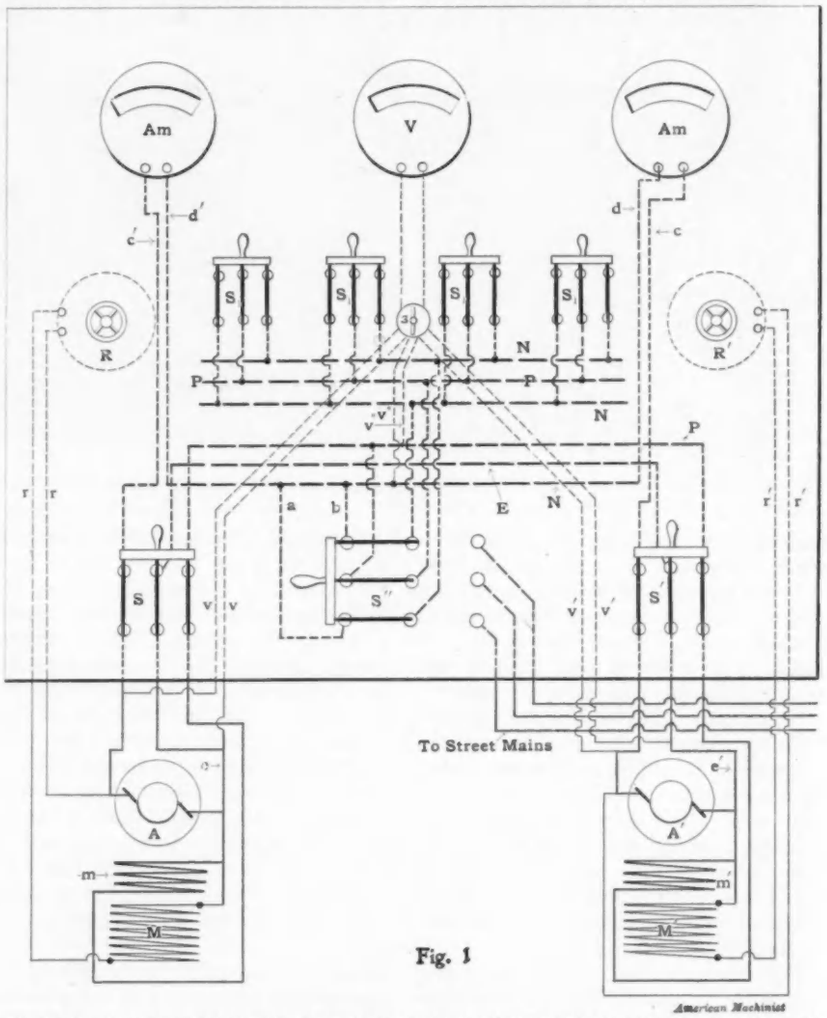


Fig. 1

SWITCHBOARD FOR TWO GENERATORS AND ONE SYSTEM OF CIRCUITS WITH STREET MAIN CONNECTION.

other hand, if we have two generators and desire to so arrange them that they may feed into several independent circuits, and be so disposed that either one of the generators may feed any one of the distributing circuits or all of them, and further, that one machine may feed some of the circuits while the other feeds the balance, then we will have a complicated arrangement, and may have to exercise our ingenuity to the fullest extent to avoid the use of unnecessary switches, etc., and to avoid too great a complication in the circuit connections.

Fig. 1 shows an arrangement of switchboard for two generators, that may be classified as belonging to the simple type. In this case the generators are required to feed into a single system of distributing circuits, and the only other condition to be fulfilled is that the board must be so arranged that if for any cause the generators fail to operate, current from the street mains may be turned on at once. From the explanation which follows, the manner in which these results are attained will be understood.

As was explained in the article above referred to, it is necessary when two or more generators are operated in parallel, to connect the entering ends, as well as the leaving ends, of all the series coils, so that the current may divide equally between all the generators. In Fig. 1 the equalizing connection runs to the center contact of the main switches S and S'. The connections from the ends of the series coils run to the right-hand side contacts of these switches, and the connection from the left-hand armature terminal connects with the left-hand contact. If switch S is opened, the left-hand generator will be cut out of the circuit, and if switch S' is opened, the right-hand generator will be cut out. When either one of these switches is closed, its respective generator is connected with the circuit, the center contact, which is the equalizing connection, connecting with the center bus E, which is called the equalizing bus. If the two switches are closed, the two generators will be connected with the circuit, and their equalizing wires will be connected through the bus E. The current from switch S' passes to the ammeter on the right side of the board through the wires c and d, and the current from switch S passes to the other ammeter through wires c' and d'. The voltmeter V can be connected with either generator by means of the switch s, and also with the buses N and P, as is clearly shown by the wires $v\,v$, $v'\,v'$, $v''\,v''$. Under the ordinary running conditions, the voltmeter is connected with the buses, and the switch s, when turned to make this connection, disconnects the wires leading to the two generators. If one generator is running, and it is desired to throw the other into service, it must be set in motion and its voltage brought up to equality with that of the running generator before its main switch is closed. Suppose the right-hand generator is in use, and that we desire to start up the other one, then we set it in motion and move the voltmeter switch s so as to connect alternately with each generator, and when both show the same voltage, the S switch is closed.

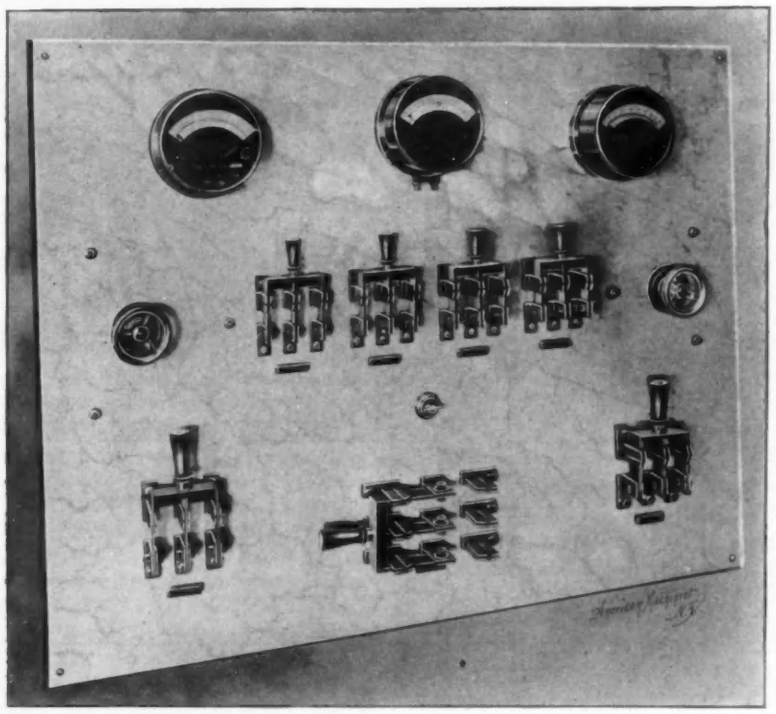


FIG. 2. PHOTOGRAPHIC VIEW OF SWITCHBOARD SHOWN DIAGRAMATICALLY IN FIG. 1.

The main switches S and S' connect the generators with the lower set of buses, but if the switch S'' is open, the current cannot pass to the external circuit. When this switch is closed to the left side, as shown in the diagram, the current from bus N will pass to the top and bottom buses of the upper set, and the current from the P bus will pass to the center bus of the upper set. With this connection, therefore, the current will pass out to the external circuit through the center bus and return to the two outside ones. The object of this arrangement is to render it possible to operate the lamps or other apparatus upon the circuit from the street mains as well as from the generators. The street service is generally arranged upon the three-wire system, hence the circuits supplied through the S switches must be arranged for three-wire distribution. Should it become necessary to shut down the generators for any reason, all that would be required to connect the system with the street mains would be to throw the S'' switch over to the right side, and then the three street mains would be connected with the three upper buses, each main being connected with a separate bus bar.

A photographic view of the front of this board is shown in Fig. 2.

In the diagram, Fig. 1, no circuit breakers are shown, owing to the fact that in this case the generators are protected by simple safety fuses. These fuses can be mounted upon the switchboard or at any other convenient point; but when upon the board they are placed behind and not in front, as they are not attractive in appearance, and when they act they are liable to deface the surrounding parts by covering them with molten metal. It is very seldom that a board is arranged so as to depend wholly upon safety fuses—a regular magnetic circuit breaker is invariably provided in the most modern installations. A magnetic circuit breaker is more effective than a fuse for sudden rises of current strength, as it will act instantly, while the fuse will not respond to a sudden rise in current strength if it lasts only for an instant, owing to the fact that it requires some time for a current to heat the fuse wire up to the melting point. Fuses are relied upon almost exclusively for the protection of branch circuits, but for the main line the proper thing is the magnetic circuit breaker.

Fig. 3 is a diagramatic view of the switchboard of the Crescent Steel Works, Pittsburgh, Pa., constructed by A. F. La Roach & Co., of New York City. It is arranged to connect two generators of a capacity of 1,000 amperes each and 250 volts electromotive force so as to distribute into a system of circuits, twelve of which are controlled directly and independently from the board, the others being also controlled from the board, but not independently. The two generator circuits and the twelve distributing circuits are

provided with magnetic circuit breakers, which also act as switches. These circuit breakers are of the two-pole independent action type. They are called two-pole because they open the circuit on both sides; thus if the circuit breaker directly above the left-hand generator is opened it will break the connection between the board and the two wires running to the generator, one to the left side brush and the other to the end of the series coil. The two sides of the breaker act independently of each other, and to close the circuit one side is closed at a time; hence the name "independent action." A circuit breaker cannot be used as a switch if it is not of the independent action type. By means of the switch *S* the generator on the left can be connected with the conductors *h i*, and by means of the switch *S'* it can be connected with *j* and *k*. As will be seen, *e* connects the center contact of the circuit breaker with conductor *g*, and *d* connects the top contact with conductor *f*. Therefore, if the *S* and *S'* switches are thrown to the left *S* will close the circuit between *f* and *h* and between *g* and *i*, while *S'* will close the circuit between *f* and *k*, through *h'*, and between *g* and *j*, through *i'*. When the *S* and *S'* switches are turned to the right, as shown in the diagram, the left-hand generator is cut out of the circuit, and the other one is cut in. If *S* is turned to the right and S' to the left the left side generator will feed into the conductors *j k*, and the right side generator will feed into conductors *h i*. The conductors *h i* lead to circuit breakers 1 and 2, and the conductors *j k* lead to circuit breakers 3 to 12, inclusive. Therefore, by throwing the *S* and *S'* switches in one direction or the other either generator can be connected with either set of circuit breakers; but whichever way the switches may be thrown both generators will be entirely independent of each other, and on this account no equalizing connection is required for this position. When it is desired to operate both generators together the switch *S''* is closed, and then the center blade of this switch connects the conductors *c* and *c'*, which come from the equalizing terminals of the two generators. The left side of the switch connects *f* with *f'*, and the right side connects *g* with *g'*; thus through this *S''* switch the two generators are properly connected to run in parallel with the equalizer connection closed. As the office of the *S''* switch is to join the two generators it is called a "bus junction" switch.

From the foregoing explanations it will be seen that either one of the generators can be connected so as to feed the circuit *h i* or *j k*, or both, and that one machine can take part of the load while the other takes the balance; or both generators can be connected to work together, and all this is accomplished by the movement of the three switches *S*, *S'* and *S''*.

The field regulators are placed by the side of the voltmeter *V*, so that the latter may be watched to note the effect produced upon the voltage of the generator when the regulator wheel is being moved. The two ammeters directly above the field regulators *R R'* indicate the current of the generators, while the other twelve instruments are placed in the twelve branch circuits controlled by the circuit breaker switches. Only one voltmeter is used, and, as in the case of Fig. 1, this is normally connected with the working circuit so as to indicate the voltage of the line, but when the generators are to be thrown into parallel connection it is used for the purpose of equalizing their electro-motive forces.

Figs. 1 and 3 show switchboards as actually arranged, to operate in connection with two generators, but, as will be seen, they are decidedly different, and the operations they are required to perform are also decidedly different. The switchboard, therefore, must be designed to meet the special requirements of the case.

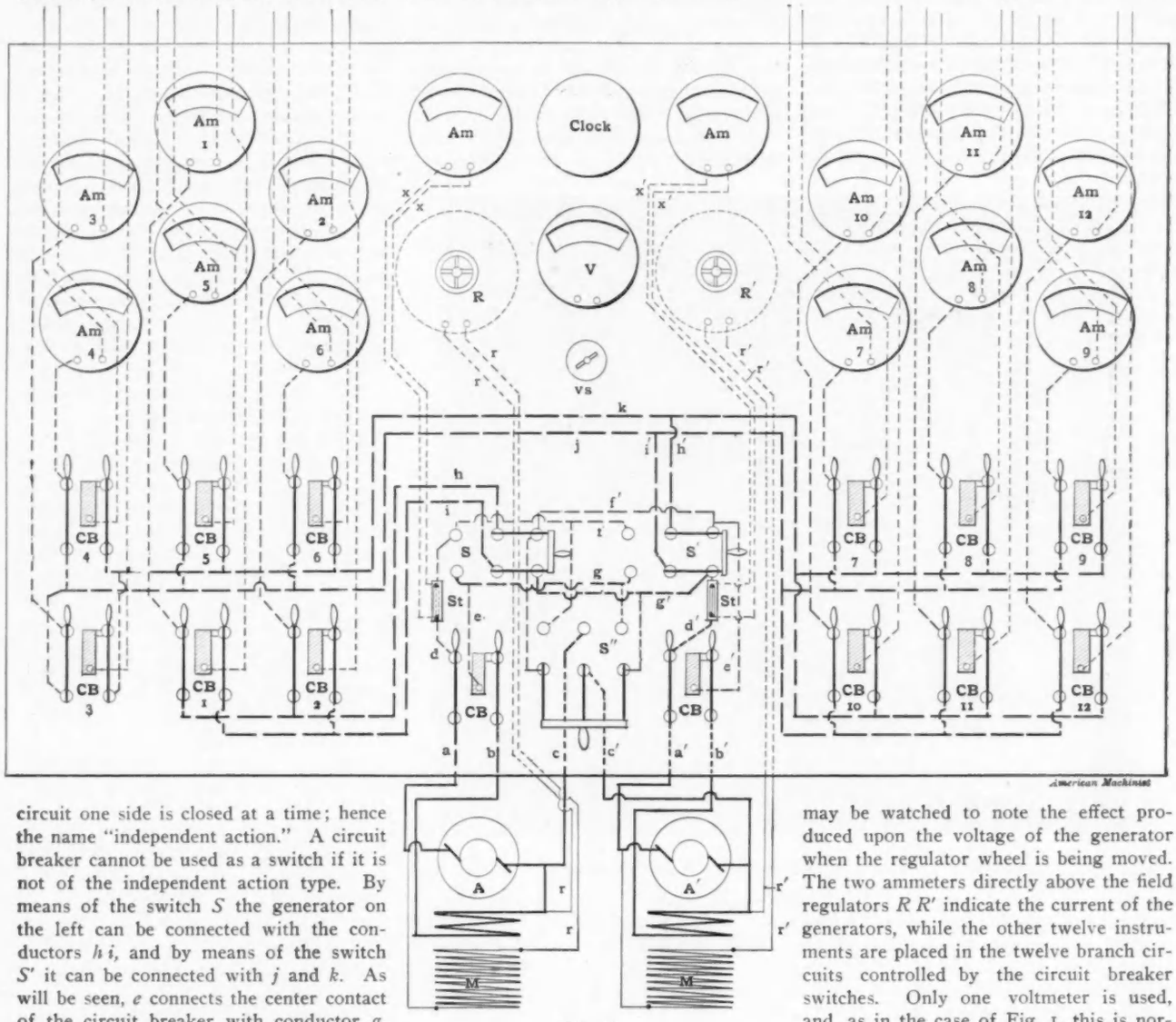


Fig. 3

SWITCHBOARD FOR TWO GENERATORS CONNECTED TO NUMEROUS CIRCUITS.

Producing Straight Castings and Methods of Straightening.

BY R. D. MOORE.

To be thoroughly equipped for handling all the crooking castings that come to a jobbing foundry requires a clear understanding of the causes by which warps are produced and the several devices for correcting them; that is, it should be known beforehand what the crooks will be, and the proper treatment for each case. Straightening by bending the pattern in the sand in an opposite direction is one of the most simple methods and easy to understand, but it is only applicable to a very limited number of cases, such as long, slender lathe beds, where the pattern has only moderate stiffness to overcome.

By Stripping.—The lintel box, Fig. 1, is a good sample of a crooking casting, and one easily treated, as it has the heavy side on top. I have handled very successfully all sizes up to 40 feet long and weighing nearly 5 tons. Although the long sizes have lately been largely superseded by the more reliable, made-up steel article, these still serve to illustrate one straightening treatment. A 12-foot lintel of this form would have a top plate, as molded, say, 1¼ inches thickness, the sides ⅞ inch tapered down for draft to ½ inch at the bottom. Such a casting would cool very irregularly as to time. The top side, when the cope was removed, would be a bright red, while the thin edges at the bottom would be a very dull red, and the casting still straight. Such a combination, with irregular shrinkage to follow, would promise a crooked casting; that is, the top side, having the most shrinkage to occur, would become too short, and would be concave a half-inch or more, or contrary to mere shrinkage set. It presents a simple case. The metal has been distorted by shrinking irregularly under confinement, and the remedy lies in stretching the top side by stripping two or three sections near the middle, or about 5 feet of its length altogether. Cooling the top, if it cannot lift the ends, is a stretching process on the top plate. Weighting down the ends would be harmless in this case, and might be needed, as a lift of the ends would defeat the stretching of the top plate.

By Heating.—An 8-inch fluted building column 12 feet long, which, on account of the anchor blades being too thin, had sunk into the loam core, allowing the core to rise and which promised a crooked casting, was treated thus: The top was stripped nearly bare and 100 pounds of cold melted iron poured, a little at a time, all over the top, then all was well covered with sand. On examining it later the color of top and bottom was found about equal, and the casting in the morning proved to be straight, a more valuable quality in a column than perfect equality of metal; and this treatment reduced the permanent shrinkage strain by insuring an equal time of cooling. With a stiff cast "barrel," the core, at the exact center, probably raised ¼ inch, leaving ½ inch on top and 1 inch on bottom, instead of ¾ inch all around.

By Bending, while hot, in the sand.—There are a few cases of long, slender castings showing objectionable warp, on account of unequal cooling, where the warp can be corrected very easily, and with more certainty than by any other process, by simply bending the flask in an opposite direction from the warp. The bend should be made soon after pouring, or while the metal is still a high red, so that it will yield easily and receive the true set without fracture. My first experiment with this device was on stationary engine beds, the casting forming one side of a bed for 16 and 18-inch cylinders, with 4-foot stroke, and used quite extensively for driving Louisiana sugar mills. They were of the bold-paneled, ogee-molding style, 20 inches wide, 8 inches deep, and 22 feet long. Fig. 2 presents a section cut through one of the four panels. They were cast with the face down, as shown,

Fig. 1

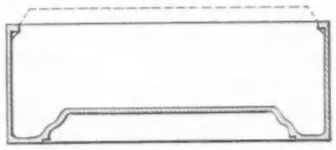


Fig. 2

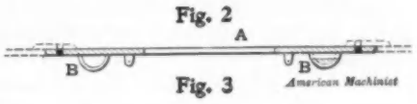


Fig. 3 *American Machinist*

the inside being formed of green-sand cores hung in the cope with two screws in the wrought-iron core skeleton, the pattern being solid. The dotted lines show the core print guides for setting the cores, which were hoisted to place on the bottom of the core box. With green-sand cores there will be considerable strain, a thickening at the bottom, which will increase the warp. These warped according to rule; that is, the ends sprung down 1¾ inches. Soon after pouring I set a heavy bar of iron under the bottom board, two or three feet from the end of the flask; then hooking on two sling hooks, hoisted the flask end until the end batten showed a lift of fully 1¾ inches from its bed. Plenty of large wedges were then driven under several of the battens for a firm support. The crane was then taken off and the other end of flask was treated in the same way. The flask in this case was of iron, but, being long and relatively slender, it bent under its weight with a very regular curve, producing a very true casting every way. These engine bed castings, thus treated, averaged between 36 and 50 a year for a long term of years, and not costing a cent for treatment, the device proved valuable.

By Reheating.—These bed castings had formerly been straightened by the machinists, who fitted them, under the direction of a very incompetent manager, by reheating with a wood fire and weighting down. They blundered in many ways, and obtained an imperfect job in every attempt. They persisted, against repeated advice, in resting the casting on one center bearing, and in heating a very short section only, compelling a few inches of the length of it to stand an excessive amount of stretching, and almost invariably starting perceptible cracks, and kinking the top edges by excessive compression; that is, the top edge, as molded, but the bottom when straightened. There is no excuse for committing such violence on a few inches of length when we have 22 feet to act on, and worn-out flasks to slaughter. Besides, the longer the bend, the nearer the curved line is converted into a straight line.

Straightening by fire will be found to be one of the most delicate and difficult feats for the manipulator of castings. One of the most universal faults observed is the habit of piling on an excessive load of weight before heating, thus often cracking the casting before the highest heat is reached; the weight necessary is often surprisingly small. After witnessing many of those imperfect jobs, I volunteered to try one, and succeeded well in the following manner: The bed was placed on two bearings, about 4 feet apart and 4 inches high. A rough wall of fire-brick or double grate bars was made, 8 or 10 inches from the casting, to check the draft and the escape of heat, also to confine the fire closer to the casting. A strong wood fire was then applied to fully 5 feet of the middle of the casting. Gage blocks were set under each end to bend the casting to, but they were not final, as they should be adjusted when the bend is made. The heating may have raised or lowered the ends, and then the bend given would be out to that amount. To prevent the long ends from settling too soon, when heated, a lever was placed under each end and a bar or plank to sustain one-third to one-half of the projecting weight until the time came to adjust the gages and weight down. Such levers, carefully poised, will accommodate themselves to the heat bends, and not distort the casting beforehand.

I once had a very interesting experience in straightening the center or column pieces of fire fronts used on Western steamboats. The castings were plates about 26 inches wide, 42 inches long by ⅞ inch thick. Such a form has none of the crooking elements, but the manager thought it too plain, and he punted up a 4-inch column pattern, not in use, and nailed the two halves on the front of the pattern, coring them with a half core, as

shown in Fig. 3, which presents a section, split through a door opening at *A*, the dotted lines showing the adjoining overlapping plates, three plates constituting one boiler front. The columns were only ¼ inch thick, and cast on one side of a ⅞-inch plate, made a combination very favorable for a crooked casting. The manager was duly warned of this tendency, but he replied only with a sneer. As one might have reasonably expected, those short plates warped a half an inch; that is, they came out hollow, or concave, on the side opposite the column. They were of course required to be nearly straight to match the adjoining plates. A few of the best were stretched with a hammer, but they were mainly so crooked as to require bending when red hot. The fitters made some attempts at straightening with fire, but generally failed; they piled nearly a ton of pigs on each end before lighting the fire. After the fire had weakened the casting, it settled under its load, and, not being soft enough to properly bend, it broke and was condemned. I finally offered to experiment, and with success, in the following manner: After the casting was set, eight light pigs were placed on one end, and three pigs on the other end. The casting was then heated up to a good red, then pigs were added until it settled to the bearings. Six light pigs, on each end, were found sufficient, showing that the former practice was overloading, three or four to one, and ruining good castings, mainly by that error.

Not having the time to spare for treating five or six castings for every boat we were building, I adopted another trick, which removed that trouble for the years following. I, "on the sly," fitted a board in the bottom of the column core-box, which added enough metal, out of sight, to make the shrinkage even and the casting straight. The added metal is shown at *B B*, Fig. 3.

A British Opinion of American Tools and Methods.

An admirable paper on "Machine Tools," by Ewart C. Amos, M. I. M. E., was presented at the April meeting of the (British) Society of Engineers. The paper complete, with all its illustrations, would fill thirty of our pages, so that it is impossible for us to reproduce it. The following extract, wherein the author speaks intelligently and fairly of American tools, will be read with interest:

"After careful inquiry, the author is forced to conclude that with the exception of certain leading firms, who are turning out machines equal to any of those imported, the majority of tool manufacturers in this country are not keeping pace, either in quality or design, with the American and other tools now being imported, and the very fact that so many of our tool manufacturers here are buying for their own use considerable numbers of American machines, proves conclusively, without other evidence, the style and quality of machine the Americans are sending over.

"It might be well to say here that the author is neither interested in nor connected with any American firm of tool makers, and to add, that notwithstanding the conclusion already expressed, he is still of opinion that it lies in the power of the majority of the British makers to turn out work which shall compare favorably with the best imported article, but to do this means considerable alteration from the present method of manufacture, besides the destruction of large quantities of old and obsolete patterns. This, no doubt, would be a sore point with many, as the old idea of what once worked well can never work better, and what was good for our forefathers should be good enough for us, is so powerful an argument with many that nothing short of better machines actually coming into our markets and ousting old and inferior designs would have brought about the change which is gradually taking place. It therefore becomes an open question whether the advent of the foreign tool is not a blessing in disguise, especially at the present time, when, owing to the comparative scarcity of tools, our own manufacturers, who are in need of increased productive facilities, are able to add to their plant by buying American machines. This advantage is of a dual nature, as it enables them to appreciate the best points of the foreign article through practical use, and at the same time to introduce in their own manufactures similar advantages.

"It must not be forgotten that very many of the ideas embodied in American machines, originated in this country, but American makers have perfected or modified them, and having given great attention to detail, have produced a machine which is practically a great advance on the original. For instance, the author believes it is a fact (although he is open to correction) that the boring mill, which has already been referred to, was first made in this country, although it is generally looked upon as of American design. Doubtless American makers have added improvements, although some English-built machines require a lot of beating.

"The most striking difference between the two makes, which is in favor of the American, is in the design, nor can it be said that American machines are wanting either in accuracy or finish. Doubtless there are a number of these machines which are not altogether satisfactory, but we do not see many of them over here, the better class only being imported, and it will hardly be disputed that the American tool as a whole is a well-designed and carefully proportioned machine, adapted to turn out the maximum of work with the minimum of labor. Tool-makers are in a way guided by the requirements of their customers, and in the absence of a different class of tool being asked for, they continue to supply the same old thing. But the Americans, having studied the question carefully (the high wage-rate they have to pay being a strong incentive), have introduced here an improved class of machine, and have proved to us the great saving effected by its use. What is the result? Why, that the English tool-makers are rapidly following suit, and it may be said with pleasure they are in some cases going one better. But the progress is slow, and in the meantime we are to some extent losing our market and have to face a competition which hitherto had no existence—a competition, moreover, which is likely to be a serious matter in the near future. It is not disputed that our tool-makers have been for some time, and still are, exceedingly busy, the boom in the trade being one of the largest on record; but unless the future should prove very different to the past there will be a slump to follow as soon as our abnormal Admiralty and other government contracts have been completed. The cycle boom, which created a demand for a special type of tool, and called into existence several new firms who devote their energy almost exclusively to cycle tools, has been on the wane for some little time, and has encouraged the American manufacturer also to seek other clients and extend his connection. One thing in particular to which the author wishes to call attention is the fact that American tool-makers go in for a few specialties in which they excel, and do not attempt to make every class of tool, which is such a prevalent practice with our own makers. Without elaborating this point, it may safely be said that it goes a long way to explain how it is that American firms can deliver their machines in this country at a price which competes with the home products.

. . . . . .

"Of the lighter class of tools, hand tools, etc., the American make is undoubtedly superior to our own, and the competition in the larger machines is getting very keen. Then, again, where the American makers gain so much is in their method of manufacture. Their practice is to put in hand at least a dozen machines at the same time, stocking what is not to order, while we manufacture as a rule to order only. Their system enables them to use elaborate jigs and templates, which secure accuracy, economy and rapidity in manufacture, but does not pay in the case of one machine. Having set a tool to mill, plane or drill a certain piece of work, it is evidently economical to be able to machine, say, a dozen or fifty of the same kind before removing the jigs and resetting the machine for other work. These are points which just make it possible for

Americans to sell a machine at prices approximating to our own, and often of better quality, notwithstanding the fact that they are paying a higher wage-rate, and have freight and other expenses to add. Knowing the large business which agents are doing in American machinery on this side, it is useless to disguise from ourselves that they are a factor to be dealt with from a competitive point of view. This is now recognized, but at the same time it is to be hoped that the great strides made in mechanical engineering during the last few years will call for the use of so much machinery as to make room for both classes of machines, promoting at the same time a healthy competition."

Liquid Air for Automobile or Portable Service.

BY FRANK RICHARDS.

We none of us know now as much as we will know a little later about the best methods of using liquid air, whether for power, for refrigeration or for other service, or of the practical value of the effects realized in proportion to the cost. As it has been suggested that liquid air may be made serviceable for the self-propulsion of road vehicles, it seems to be in order to offer some suggestions or to indulge in a little speculation, as to the way to do it and as to what would come out of it.

Liquid air represents, among other things, stored energy, and energy which may, partially at least, be reconverted and employed for our service. Liquid air is compressed air in an easily portable form. The advantage which it has over high-pressure, non-liquefied, compressed air is that it is not dangerous to convey or to hold, and that it does not require many and costly bottles to contain it. The liquid may be carried in a milk can, or in anything that will hold water, and which is merely strong enough for the weight of the water without any added pressure, although it is quite imperative to surround the vessel with large quantities of heat-insulating material. Even with abundant insulation provided, a given charge of compressed air in liquid form must weigh much less than the same charge under high pressure, and not liquefied but contained in the necessary steel bottles. The shape of the vessel in which the liquid may be conveyed may be made to conform to the conveniences of the vehicle, while high-pressure air insists upon its long cylindrical receivers, which must be disposed of as best they may.

In the previous article I spoke of using liquid air for maintaining supplies of compressed air in receivers of considerable capacity, and where the use of the air was slow or intermittent, the liquid air being occasionally inserted in charges sufficient to restore the fallen pressure in the receiver within certain predetermined limits. An entirely different system would have to be followed in the case of the automobile. All the liquid air for a trip, or for a run between charging stations, would be carried in the liquid state, and usually in a single receptacle, and there would be practically no compressed air reservoir, or any receptacle required for any considerable volume of compressed air after its re-evaporation. The liquid air would be pumped into the working compressed-air system just as it was wanted for use, and almost precisely as the feed water is pumped into a steam boiler. The boiler in this case would necessarily be of the tubular type, with the important difference from the steam boiler that the requirements for the evaporation of the air would not call for the assembling of the tubes in close proximity to each other and around or over the fire, for there would be no fire. The heat required would be obtained from the surrounding atmosphere, and the tubes, or the single continuous tube, would be so disposed as to get the best exposure to the air. In the automobile it would be most natural and proper to have the air traverse a coil spread out in front of the machine, so that the air would strike it with some velocity when the vehicle was in motion. After the air had by this means attained the temperature of the external atmosphere, its mechanical status and value would be precisely the same as that of compressed air which had been produced directly by compression in the usual way, except that the liquefied and re-evaporated air would be absolutely dry air, and would be entirely incapable of causing any trouble by freezing up in the passages of the motor. The air after attaining normal temperature might be passed through a reheater, heated by a little oil lamp or other means, and the consequent increase of volume would add considerably to the efficiency of the air as in other cases. If the air was used in a compound motor, it should certainly be passed through a reheater first, and also again before entering the low pressure cylinder. If the latter re-heating was not effected there would be little or no reason for compounding.

With this general scheme for using liquid air for an autocar motor, the vehicle that I have in mind just at present is a tricycle for a single person, and to be used for service similar to that of the present bicycle. Say that we have a receptacle that will hold 50 pounds of liquid air, or something over 6 gallons, and that 10 pounds of the liquid will be evaporated and lost during our trip through the park and up the boulevard, leaving 40 pounds of liquid air available for use. Our working pressure will be, say, 100 pounds to the inch. As a cubic foot of air at 100 pounds weighs, say, 6 pounds (see preceding article) we have available $40 \div .6 = 66$ cubic feet of air at 100 pounds. Our motor has a 1-inch diameter cylinder, 2 inches stroke, normal speed 300 revolutions per minute; connected to the driving wheels by differential gearing of wide range. Cutting off at quarter stroke, the mean effective pressure will be 44 (see Richards' "Compressed Air"), and the theoretical power developed will be: $1^2 \times .7854 \times 44 \times 100$ feet piston speed $\div 33{,}000 = .1047$ horse-power, and the air consumption per minute will be: $1^2 \times .7854 \times 4'' \times \frac{1}{4} \times 300 \div 1{,}728 = .1363$ cubic feet, to which we should add 10 per cent., making the consumption .15 cubic feet per minute. As we have 66 cubic feet available, the charge should last $66 \div .15 = 440$ minutes, or say 7 hours, which, at 8 miles an hour, should be as far as anyone should want to ride at one time, and it would only be necessary to pour in the liquid air again to be all ready for a ride as far again. With liquid air in sight as low as 2 cents per pound, this riding is distinctly cheaper than the maintenance of a horse. In the few figures here given nothing is said about the gain that might be accomplished by reheating. This it would be very proper to go into for larger vehicles, and also the compounding of the motor. With air at an initial pressure of 200 pounds, and reheated both before entering the first cylinder and also intermediately, it should be easily possible to show results 50 per cent. better than here indicated.

Award of Prizes for Suggestions.

The issue of the "N. C. R." for July 15 is at hand and contains a full account of the semi-annual prize distribution to employees of the National Cash Register Company, which took place July 8. There were, as usual, fifty prize winners, who received from $5 to $50 each for the best suggestions offered during the preceding six months. In the course of the ceremonies attending the event—they always make this matter an occasion for a picnic, speech-making, etc.—President J. H. Patterson gave the following account of how the system originated. He said:

"Probably it would be interesting to you to know how this suggestion idea was first brought to our attention. About four years ago a member of our organization said to me: 'I used to weigh coal for you in Jackson County, but am now cleaning castings in the back of your foundry.'

"'Why are you doing that?' I said.

"'Because I cannot get anything better to do,' he replied.

"'Make some good suggestion,' I advised him, 'and do something to help out, and your merit will soon be rewarded by promotion.'

"He replied: 'If I should do that you would never hear of it; it would be

smothered long before it got to you, and I would get no credit for it.'

"That opened my eyes. For three months I labored over that problem. I thought what a great opportunity it was; how rapidly the company would progress if we had twelve hundred brains working for us, correcting wrongs and helping us on what was right. And from that came our suggestion system, which has more than any other cause pushed this company forward.

"Good suggestions are inventions, because they are something new. Instead of giving a man a patent, we give him an acknowledgment. To the fifty who have originated the best inventions we give special prizes. We only wish we could do it for all."

A study of the suggestions for which prizes were given is, as usual, interesting. It is not generally expected, for instance, that girls employed in a factory will be much inclined or able to make suggestions of value pertaining to manufacturing operations, yet we find in this list five feminine prize winners. One girl received $15 for suggesting that certain colors be put into counter-plates by printing instead of painting. Another girl received the same amount for suggesting "that the fixture for marking No. 79 indicators be made to accommodate twelve indicators instead of two." Five dollars was awarded to another girl for a "suggestion to make the No. 79 side-lock-frame cap to come the correct size from the tools and avoid cutting off the ends; (2) to use 192 special-counter frames that were made wrong," and a similar amount to another girl for a "suggestion to put lever and thumb screw on key-stop drill jig, No. 35, to hold the key stops better in drilling the pin holes in the ends."

As showing the fairness with which employees are treated in this matter, we may mention the case of G. D. Osmond, of "No. 79 assembling department." He received $5 for a "suggestion to make the No. 1 counter throw-out lever for No. 79 so that the guide will be a part of it instead of a separate piece. While this was not done just as Mr. Osmond suggested, his suggestion led to the improvement."

It will be noticed that the payment of $5 to this man for a suggestion which was not even adopted but which led to an improvement is in very strong contrast to what would be the usual procedure in such a case, and we may be sure that the future attitude of Mr. Osmond toward the company and his feelings about making suggestions and improvements connected with his work would be found to be in equally strong contrast with what we should find in an employee treated in the usual manner. Of course the company receives many suggestions for which prizes are not awarded, there being a total of fifty prizes given for the best suggestions.

An English Clothes-pin.

A friend sends us a mechanical curiosity, in the shape of an English clothes-pin. It is composed of three pieces—a piece of pine wood, a strip of tin-plate and a tack. The wood is very roughly whittled out, split part of the way up, and the opening flared to go over the line. The tin is wound in a spiral line about the top, to keep the split from extending to the upper end, and the tack secures one end of the tin. The aggregation is about as uncouth an object as one may hope to see. It is manifestly made entirely by hand, and how it has survived, in view of the fact that the neat and cheap machine-made forms with which we are familiar have been made for many years, is a profound mystery. It makes one laugh to look at this clothes-pin, and it was evidently a laugh that inspired the note of our friend, which accompanies the pin. He says:

"I am sending you, under separate cover, a real, live, hand-made, spring-actuated, double-jointed, fish-mouthed, English clothes-pin. After having been in England nearly three years I have just become aware of the existence of this piece of domestic mechanism, and it struck me so forcibly as a curiosity I thought I would send it to you, thinking it might bridge over a few dull moments of the day by your studying its wonderful construction. When I first saw it I thought it was a joke, but I find it is manufactured, sold and used by the million in this country. Just imagine a thing like this being made in Birmingham. I send you the best sample I have, as I am afraid you would take it as a joke; but this sample is really quite flattering to the manufacturer, whoever he is. You will observe that his name is conspicuous by its absence. Some think that this clothes-pin was introduced into the country by the Normans, and others say that it was brought in by the early Romans, but they cannot prove that either of them used to wash clothes at all in those days. Some say that Henry VIII had Anna Boleyne executed for no other reason than that she left his shirts out on the line over night during the rain. The rust from the tin of the clothes pin so stained the shirts that he got mad and had her beheaded. I don't know about this. It isn't in my history, anyway; but it is hard to believe that the country of Watt, Stephenson, Whitworth, (Austin), and scores of other great lights should be guilty of originating such an ungainly article of domestic use as this clothes-pin. Of course they have some American clothes-pins here, but they are in the minority. I believe they were introduced by Sir Walter Raleigh, for which he lost his head. If you survive the receipt of this curiosity, I may possibly send you another one some time of a different nature, but I will wait and see."

German Machine-Tool Trust.

The following, taken from a recent consular report, may prove of interest to those engaged in the manufacture of machine tools. The trust referred to was formed in the spring of 1898 and comprises the majority of the works manufacturing machine tools in Germany. The first annual meeting was held a short while ago in Dusseldorf and reports for the year 1897 as follows:

"Our supervisory committee has given the matter of tariff policy careful consideration, in order to be able to supply concise information to the German imperial authorities as to the productive capacity of this branch of manufacture. The declarations of the firms belonging to this trust, as well as of others outside of it, concerning the question of tariff policy have demonstrated the necessity of affording stronger protection to this industrial branch. Stringent measures are especially required in the importation of American tool machines. It is also necessary to take steps to have transportation rates to, and the tariffs of, countries in eastern and northern Europe reduced, so as to stimulate the export of German machines. Investigations concerning this branch show that in 1897 there were employed in 208 tool-machine works (out of a total of 220 firms operating in Germany) over 26,000 hands, who received a little over 24,000,000 marks (about $5,700,000) in wages. The product of these 208 works was valued at 70,000,000 marks (almost $18,000,000), and about three-fourths of the machines produced were exported. This branch of industry is therefore important, and returns for 1898 will show further progress. Almost all the works engaged in making tool machines have undergone large extensions in the last year, and their output is consequently increased."

In these days of big contracts no figures seem to be large enough to excite much astonishment. It is reported that the Pressed Steel Car Company has contracted with the Carnegie Steel Company for 30,000 tons of steel plates per month for ten years, and to execute it the Carnegie Company is to erect additions to its plant to cost $3,000,000. The entire contract will amount to over $60,000,000.

Among the excellent pieces of work recently accomplished under the auspices of the "Merchants' Association of New York" is a report by Mr. William R. Corwine on Porto Rico. Mr. Corwine went to Porto Rico as a representative for the association named, and his report on the commercial conditions there and his opinions on what is necessary to put things upon a progressive basis ought to be of special value to those who feel responsibility in this matter.

Work and Workmen in Two Berlins.

The Berlin Iron Bridge Company, of East Berlin, Conn., recently erected a large foundry building in Berlin, Germany. Mr. George Klimm, a foreman of the company, with ten men, was sent to Berlin to put up the building, and his account of his experiences and observations, as recorded in the Hartford "Courant," contains several items of interest, of which we extract a few:

"Mr. Klimm, in describing the customs of the German workingman says: 'The ordinary German mechanic takes a cup of coffee as soon as he gets up and starts in to work at 6 o'clock in the morning. At 8:30 he knocks off for breakfast, at noon for dinner, and at 4 in the afternoon he knocks off for lunch, but works until 7 in the evening, when he quits for the day and for supper. The food of the ordinary German mechanic is much plainer than we are in the habit of receiving in this country. You must be aware of the fact that bridge builders like myself are in the habit of traveling all over the United States, and are familiar with all kinds of fare, but the poorest and plainest I have had in my twenty years' experience was that I received in Germany. We had very little meat and no pastry whatever; but of beer we had any quantity at all times, in all places and under all circumstances. In fact beer seems to take the place of bread with the German workingman. I took over with me ten men from here, and employed from ten to fifty Germans on the work at Berlin, while it was progressing. The German workingmen are not in it with the American. They don't, as a rule, show any ambition. Of course there are exceptions, and I had many Germans in my gang who were good men; but, after an experience in all parts of the United States, from the negroes of the South to the lumbermen of the North, I have no hesitation in saying that the ordinary Yankee will do as much as any two Germans. At least, that is my experience. They pay their men about the same as we do here. In fact, I found that I had to pay my labor help in Berlin as much as I did in almost any part of the United States; but they are not good mechanics and they do not seem to have any idea of taking any advantage of their work. They stand around for the boss to show them how to do anything rather than to go ahead on their own hook. This was especially the case with men working aloft. In fact, where an ordinary American bridge builder would hang on with his legs and work with his hands, the Germans insisted that they must have a staging built, while in ninety-nine cases out of a hundred the American would have taken less time to do the work than he would to have put in the staging.

" 'How does the quality of our work compare with that furnished by German bridge builders?'

" 'I had very little opportunity to observe, but the work which I saw at Berlin, built by German bridge builders, seemed to me much inferior to that furnished by my own company. All our work was carefully punched and fitted before it went from here, so that my work consisted entirely in putting it in place. The German erectors were very much interested in our method of handling this work, and they were all much astonished to find that I did not have a lot of reamers and hack-saws in my outfit. In America a bridge builder's outfit contains a hack-saw and a reamer; but in Germany it is the principal tool, as the work is so poorly fitted at the shops that the greatest portion of it must be reamed and fitted in the field.

" 'I am, of course, employed by The Berlin Iron Bridge Company as a foreman, to erect their work, and know nothing about prices; but from what I saw in Germany, I am satisfied from our improved methods of manufacturing that the American bridge builder can compete successfully with the Germans, and I believe this business will develop rapidly, for certainly they have nothing in Berlin to compare with the building which we lately completed.' "

Rules for the Supply of Light and Power at the National Export Exposition.

The management of the National Export Exposition, to be held in Philadelphia, has issued rules to govern the supply of electricity, steam, gas, water and power from shafting.

Electricity will be furnished by the Exposition Association for incandescent lighting at the rate of $4 per sixteen candle-power lamp capacity, and electricity for power service will also have to be paid by the consumer, who will, in addition, be required to furnish and maintain the necessary motors. The charges for service connections with the main line to the consumer's switchboard will be as follows: For one horse-power or less, $10; for more than one and less than three horse-power, $15; for five horse-power and less than ten horse-power, $20, and for ten horse-power or over, $25. Charges for service will be based on the maximum electrical horse-power of the motor, irrespective of the class of work to be operated, as follows: For one-quarter horse-power or less, $10; for more than one-quarter horse-power and not exceeding one-half, $20; for more than one-half and not exceeding one, $40; for more than one horse-power and not exceeding two, $60, and for more than two horse-power and not exceeding five per horse-power, $25. For large installations the rate will be $25 per horse-power for the first five horse-power, and $15 for each additional horse-power.

The main aisles of the Exposition buildings will be illuminated free of cost, but a limited number of arc lights will be supplied for private lighting on the following basis: The consumer shall pay the cost of wiring and shall also pay for service at the rate of $35 per lamp of 2,000 candle-power. Service connections for electricity for charging storage batteries and for miscellaneous purposes must be paid by the consumer the same as that furnished for power service. The current will be provided at the rate of 10 cents per kilowatt hour, though this rate will be subject to discount for current supplied at hours which the engineer-in-chief shall specify.

In the matter of gas, the permanent wings of the buildings will be lighted free of charge to the exhibitor, though gas lighting in these wings may be installed in different parts as approved by the engineer-in-chief on the following basis: The exhibitor to pay for the cost of piping and fixtures used in his exhibit, gas to be furnished at the regular city rates not to exceed $1 per 1,000 cubic feet for whatever purpose used. Water will also be supplied at the city rate of 30 cents per 1,000 cubic feet, and here also the exhibitor must pay for all connections.

The consumer must also meet the cost for all piping and connections for steam from main lines, and these must be erected and covered with non-conducting material. The rate will be $20 per horse-power for amounts less than five horse-power; for larger amounts the rate will be $15 per horse-power, and the working pressure at the boilers will be 125 pounds per square inch. To secure power from shafting the exhibitor shall supply and erect the pulley on the main lines, together with all belts and connections to operate his machinery. All pulleys must be balanced, and pulleys for the main shaft must be made in halves, and so secured to the shafting as not to weaken or injure it.

A Memorial of Former Days.

About the center of the enormous Krupp Works at Essen, Germany (now employing about 44,000 men) stands a small cottage or hut, on which is the following memorial inscription:

"This is the small house into which we moved in 1822, after my father had, without success, sacrificed to the invention of the manufacture of cast steel a considerable fortune and his whole stock of vitality and health. This was the only dwelling of the family where I lived through a number of years of suffering and sorrow; whence in 1826 my father was carried to the grave; where in the attic I have passed hundreds of sleepless nights, in trembling anxiety and with little hope for the future. In this house, after small successes, my hopes were realized, and I have since seen the fulfilment of my boldest expectations. I desire that this house shall be kept intact

as long as the factory exists, in order that my successors as well as myself may behold this memorial of the origin of the great works. May this house give courage to the faint-hearted and help him to persevere; may it also prevent him from despising small things and keep him from vanity; may it encourage others who are in distress; may it increase their respect for humble homes and their sympathy for the great sorrows which often dwell therein."

Electrically Driven Thirty-inch Driller.

We give engravings of an electrically-driven driller which has been designed especially to be driven by a motor, and we think it will prove interesting.

The method of driving machine tools by electric motors, using standard motors and driving by various combinations of belts or gears, leaves much to be desired, many of the arrangements taking up valuable space and using a great many gears or belts to transmit the power where it is wanted. In the machine shown, the motor is built into the arm carrying the drill spindle, the magnet frame, seats for motor, drill spindle and gearing bearings being cast in one piece, as shown.

The motor has a four-pole field and a two-circuit winding on the armature, with two commutators, which, with a resistance that may be inserted in the field circuit, gives four changes of speed for the motor. Three changes of speed are obtained through the nest of gears at the right, giving a total of twelve speeds for the drill spindle. Three rates of automatic feed for each spindle speed are obtained by the cone pulleys, as shown.

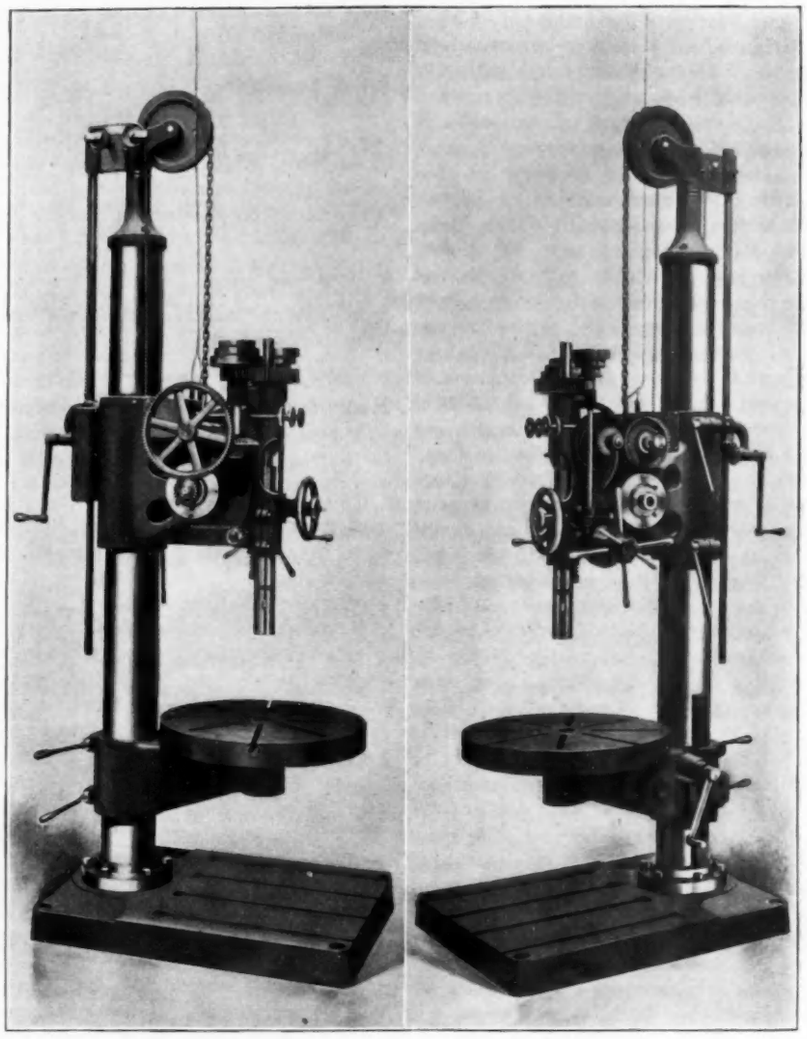
The speed controller of the motor is operated by the left-hand handle (shown in front of the spindle), and the starting switch by the right-hand handle. The starting switch is held in the on-position by a catch which is released by hand, or may be adjusted to be released by the automatic stop at any desired point. When this handle is released current is shut off from the motor and the drill is stopped.

The speed-controlling handle has a small dial and pointer connected with it, and this dial is stamped with the speeds of the drill spindle. To obtain any desired speed it is only necessary to turn the controller handle until the pointer is opposite the speed wanted, and by means of the push-and-pull pin throw in the gear indicated by a number stamped under that speed.

By this method the entire range of speeds of the drill spindle can be seen at a glance, the speed suitable for the work in hand selected and the machine set for that speed without trials or adjusting. The arm may be swung completely around the column, and is almost balanced by a weight within the column, the remainder of the weight being taken by the elevating screw at the back. The adjustment for hight is accomplished by means of the crank, as shown.

The weight of the head and counterweight are carried upon a ball thrust bearing (shown at top of column), which allows the head to swing very freely. The counter-balance chain passes down through the center of the swivel-bearing spindle.

Current for driving the motor is conveyed to the machine by means of a flexible cable from any convenient source of supply, and, of course, the machine can be set to face in any direction. All adjustments are made by means of permanent handles.



MOTOR-DRIVEN DRILLING MACHINE.

The machine was designed by Charles E. Willey and built by James Clark, Jr., & Co., of Louisville, Ky., in whose shop it has been in use for some time.

Some Good Advice.

"It is so easy to glide into routine ways where no thought is required that many men do it unconsciously and are surprised on waking up some morning to find their occupation gone and themselves fitted for no other work. There are few things in life more pitiful than to see an old employee turned out of a lifelong position to make way for a more progressive man, and on that account, if no other, I think it is of the highest importance to preserve as far as possible that flexibility of mind which will allow you to readily adapt yourself to changed conditions, and this can only be done by keeping up an active interest in everything new going on about you. It is a good plan to early acquire the habit of attacking and solving your own problems for yourself. The benefit from this will show in many ways. Each difficulty successfully overcome makes the next one easier, and the feeling of courage and self-reliance which it engenders when you have to face new and unforeseen conditions is of the greatest value. There is a big difference between the man who for lack of confidence in himself or from laziness never takes the initiative but always follows the lead of someone else, and the man who aggressively meets his

difficulties more than half way. The former may be a good enough fellow and have many solid qualities, but he will never be more than a machine to work out someone's else ideas. * * *

"We none of us, I think, have much affection for the man who is continually blowing his own trumpet and expects us to dance to its music; but, on the other hand, too much modesty is apt to be as great a vice as its opposite. If you have any merit don't hide your light under a bushel with the expectation that someone is going to come prowling around your particular bushel and overturn it on the chance of finding a candle in that rather unusual hiding place. If he does, the chances are that it will have gone out for lack of air. Meritorious people are sometimes discovered accidentally, but not often, and therefore it behooves us all to give the world at large a reasonable intimation of our powers if we expect it to make use of them."—John B. Peddle at Alumni Banquet of Ross Polytechnic Institute.

Letters from Practical Men.

Provision for Using Soda Water on Tools.

Editor American Machinist:

We have been hoping that some correspondent on engine lathe improvement would broach the question of a proper means of keeping an adequate supply of water upon the tool and work. In our opinion no possible combination of improvements would add a tithe to the efficiency of machine tools that a stream of soda water one-fourth the cross section of the tool would give.

The tendency in this direction seems to have stopped with the screw machine, where dirty and unhealthy and expensive oil is used, mainly owing to the fact that the soda would soon cause the unprotected working parts to clog.

What we believe to be required is a general line of machine tools in which this element is a living feature of the design, machines so constructed that by no chance could the soda water get at the working parts, with a stream of water not only sufficient to keep the tool cool but that would wash the chips into a proper receptacle below and keep the deck at all times clean and clear for action.

We believe that machines constructed with a fair provision for holding a tomato can would be recognized as an improvement, but that a copious stream of water properly taken care of would be a revelation for efficiency and cleanliness.

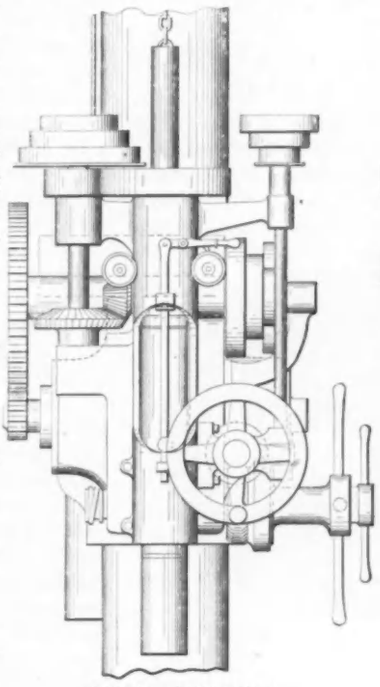
C. GODFREY WHITAKER.

Westfield, Mass.

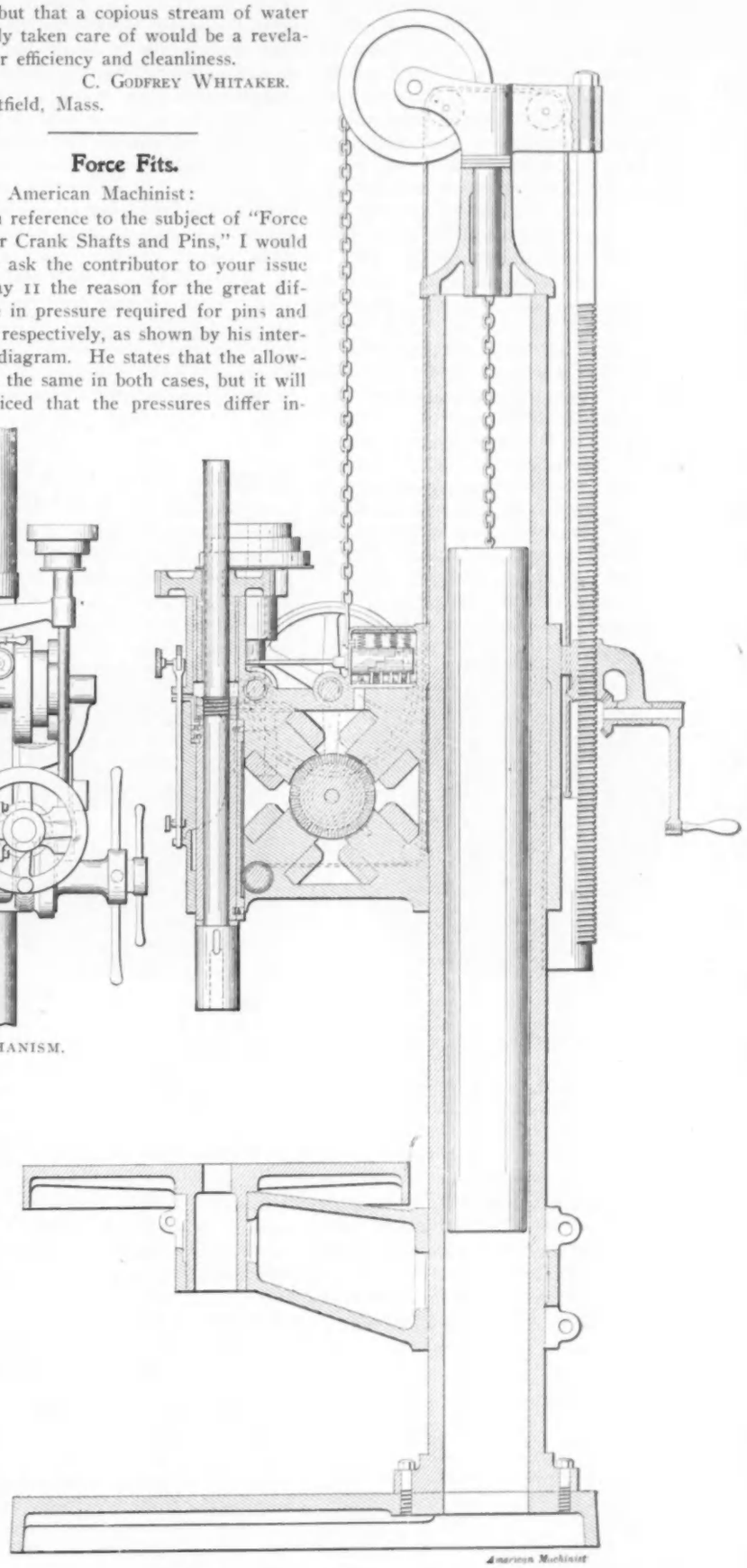
Force Fits.

Editor American Machinist:

With reference to the subject of "Force Fits for Crank Shafts and Pins," I would like to ask the contributor to your issue for May 11 the reason for the great difference in pressure required for pins and shafts, respectively, as shown by his interesting diagram. He states that the allowance is the same in both cases, but it will be noticed that the pressures differ in-



DRIVING MECHANISM.



VERTICAL SECTION OF MOTOR-DRIVEN DRILLING MACHINE.

creasingly from the smallest diameter upwards.

Are the disks cast iron or malleable, and are the holes polished? Also, are the disks keywayed.

The line in the diagram referred to, giving crank fits, agrees very closely with the English practice, with which I am acquainted, in which the disks are cast iron and the holes not polished but left as smooth as a broad tool can make them. The pins, on the other hand, are put in at approximately the same pressure per inch of diameter (a minimum of 6 tons being the rule), but the allowance given to the pins has to be reduced to meet it. I ascribe this principally to the fact that the shaft and the shaft hole are keywayed, while the pin-hole is not; but I should be glad to have some American ideas on the point.

So far as my experience goes, no hard and fast rule for the proper amount of allowance can be laid down; this depending on (1) finish of hole (whether polished or not), (2) quality of metal (whether hard or soft), and (3) design of disk (whether heavily bossed or well ribbed). The length of the pin or shaft has not much appreciable effect on the pressure required to force it home, as the maximum pressure is practically reached when the shaft is half in—that is, of course, if both hole and shaft are parallel.

PINS			SHAFTS			REMARKS
Diameter	Allowance	Press. in Tons	Diameter	Allowance	Press. in Tons	
3 in.	.006	18				
3⅛ in.	.0085	25				
3¼ in.	.0087	26				
4 in.	.0090	25				
4¾ in.	.0110	30				
5 in.	.0105	30	5 in.	.015	28	Disks identical.
			5 in.	.015	40	
			5 in.	.017	28	Disks identical, but of different design to above.
			5 in.	.017	33	
			5 in.	.016	40	Hole not polished. Disks identical.
			5 in.	.018	40	Hole polished.
5¼ in.	.0115	35				
			5⅛ in	.014	30	Considered too low, but could not press off at 50 tons.
			5½ in.	.015	32	
5¾ in.	.0125	35				
			6 in	.014	50	
			6⅛ in.	.014	28	Disks identical.
			6½ in.	.014	35	
			6⅝ in.	.013	30	Could not press off at 50 tons.
			7¾ in.	.012	50	Disks identical.
			7¾ in.	.013	38	
			8¼ in.	.011	70	
			8¼ in.	.015	36	Could not press off at 60 tons.
			9½ in.	.011	55	Disks identical.
			9½ in.	.011	70	

ENGLISH PRACTICE WITH FORCE FITS.

The accompanying table shows the variations met with in everyday practice:

On one occasion two 4¾-inch pins were pressed in with .011 allowance, and both went in at 22 tons. This was considered too low, and the disks were laid aside a couple of days until new pins could be turned. When it was then attempted to press out the old pins, neither would move at 70 tons. R. T.

Gainsborough, England.

[The editorial foot-note to the article by Mr. Hess, to which our correspondent refers, expressed the opinion that the greater pressure required by crank pins over that required by shafts of the same size was due to the increased length, though doubtless the absence of a key-way on the former and its presence in the latter would also exercise an influence. Regarding the effect of the increased length, we may say that the testimony of the Lane and Bodley observations, published in our issue of July 20, is positive that there is such an effect. We have seen the original records of these observations, during which readings were taken at the beginning, middle and end of the length, and the pressure at the end is quite uniformly double that at the middle, and this, we think, would naturally be expected.—Ed.]

Removing Tires — How Williams Got the Hub Off.

Editor American Machinist:

Some time ago I dropped into the Baltimore & Ohio repair shops at Piedmont, W. Va., and there I saw a neat arrangement for removing locomotive tires with the wheels in place under the engine, and although I believe the device has been used in other places, it may be new to some of the readers of the "American Machinist." It consisted of a piece of 1¼-inch iron pipe bent in a circle, about 3 inches larger than the tires, and on the inner side having a row of small holes drilled in it. A short piece of pipe and a length of hose were connected to this. On the floor, near by, was a horizontal cylindrical tank, about 18 inches diameter and 3 feet long, mounted on wheels. The hose was connected to this at one end on top, while at the other end of the tank an air hose was connected and arranged to project inside to the bottom of the tank.

The tank being partially filled with gasoline, the air coming in and passing through the gasoline vaporized it, and when the gas coming from the perforated pipe was lighted, it gave a row of blue jets which generated a good heat, as was demonstrated by the fact that a locomotive tire could be removed in 30 minutes, the locomotive being first jacked up a couple of inches off the rail. It will be readily seen that this device is a great saver of time and labor in a shop of this kind.

As I stood there and saw that tire drop off, there was a sort of tired feeling came over me, as it recalled an incident that occurred a good many years ago, when I had occasion to take off the tires from a small shifting engine, which came in for repairs. The shop where the work was done didn't do much in the locomotive line; yet the repairs were all plain sailing until it came to taking off the tires, and we didn't think that would be any trick until we tried it. We rolled one of them out in the yard, and getting a lot of dry wood cut short, we soon had a good cracking fire all around that wheel; but the tire didn't drop off worth a cent. The tires were pretty heavy and the wheels were not very large, so that when we did finally get the tire hot, the wheels were hot too, and although we cooled the wheels with water the tire would not let go. Well, I said I knew what would take them off. So I got a piece of pipe, perforated and bent it, much as described above, and then hitched it on the main gas pipe in the building; but although the gas meter got up and humped itself it didnt loosen those tires. By this time the job had assumed more importance in my eyes than it had at first, and I was beginning to sweat a little (mentally). I was standing there wishing they were—well, were off, when the foundry foreman came up and said in a quiet way, "If you want those tires off I'll take them off this afternoon when I pour off." "Well, I want them off; how are you going to do it?" As his explanation was satisfactory I let him go ahead. He just leveled off his sand a little and then banked it around the wheel 2 inches away and poured a streak of iron all around that wheel about 2 inches square. In a minute or two we just picked the wheel center out with the crane, and the whole job did not take as long as our unsuccessful attempt on the first one.

In telling of this experience some time ago to a man who is now master mechanic in a large mill, it recalled an experience he had years ago, before he made any pretensions in mechanical lines. When he was a young fellow knocking about he took a job once in a logging camp at a big saw mill. One day they broke the "nigger." That is a big hub with arms on it that throws the logs over, or puts them on the conveyor which hauls them out of the water. The mill had to stop until they got this "nigger" off and put on a

new one. After several hours hard sledging they managed to get the key out, but although they sledged that poor hub unmercifully it would not move. At the end of twenty-four hours they had riveted up the end of the hub so that it was probably tighter than it was when they began. In the meantime they had broken off the remaining arms to get them out of the way, and they now decided that they would have to split the hub; so they spent another night chipping away at it, but it was a big job and they did not make much headway. By this time, the superintendent (who was a rather impatient man) was getting desperate and disgusted. One young man, whose name was Williams, had not said much up to this time, but he finally told the superintendent that he believed he could get that off. The superintendent told him he did not know what he was talking about, and all that, but finally swore that if he could take it off he had better do it. He said: "Well, I want the carpenter to make me a box." "All right; I don't care what you do." Williams had the carpenter put a wooden box around the shaft and hub, leaving a space of a couple of inches around the hub. After stopping up the cracks with clay, he gathered up several hundred pounds of old lead, which he knew was there. The superintendent watched this in a skeptical way, and after Williams had melted the lead and poured it all around the hub the superintendent said, "Huh! Now, what?" Williams didn't say anything. He sat there for a minute and looked at it. Then he heard it begin to squeak inside somewhere, and in another minute the lead was solid enough to knock the box off of it, and by the time he reached around and picked up a crow-bar he just shoved that hub clear off the shaft. Williams says if he hadn't got that hub off that superintendent would probably have kicked him clear out of camp. But as it was, he just said "Huh," and walked away. Possibly this may be valuable to someone who has to take apart tight fits.

TIMOTHY BROWN.

A Simple Copying Process.

Editor American Machinist:

Reference has frequently been made in the pages of the "American Machinist" to methods of copying writings, drawings, etc., by means of the hektograph or gelatine pad and similar preparations, each having its peculiar good features. I have bought or made and have used a number of these devices, but after considerable experiment I have concluded that the most simple and useful for the everyday wants of the business man or the draftsman is one in which gelatine is not used at all, and which is so readily made, kept in condition, and used, as to be a most convenient substitute for at least a large majority of those that have been proposed.

It is prepared by making a putty of whiting and glycerine in the proportion of about four ounces of glycerine to each pound of whiting. Different samples of glycerine require somewhat different proportions, but the point is to give the mass about the consistency of the putty used by glaziers, or possibly a little harder. The prepared mass is placed in a tin tray about ⅝ inch deep, and carefully smoothed down with a putty knife or similar tool, and finally with a piece of sheet rubber packing about ⅛ inch thick, used in the manner of the well-known window cleaner.

The ink used may be almost any of the kektograph inks whose coloring matter is aniline. The following preparation of ink is perhaps as simple as any:

Violet aniline, ½ ounce,
Sugar, ½ dram,
Boiling water, 2 ounces.

Mix thoroughly, and when cold add alcohol and glycerine, of each 1 dram, and dilute carbolic acid 2 drops. The usual dyes sold in the drug stores for coloring fabrics are proper for this purpose, but those for coloring cottons should be chosen, rather than those for woolens.

The violet aniline makes the strongest ink, although other colors do good work, the proportionate number of copies that may be made being about as follows for the usual colors:

Violet, 60 copies.
Red, 40 copies.
Green, 30 copies.
Black, 15 copies.

Much of the success attained is due to good ink, whatever the copying surface used, and, generally, the number of copies which are said to be possible with a certain form of pad is greatly exaggerated. The pad above described is used in the same manner as the gelatine pad, but it has the great advantage that after use every trace of color may be instantly wiped off with a sponge and clean cold water, leaving the pad ready for use by taking up the surplus moisture with a piece of old newspaper laid flat, smoothed down, and in a minute removed. In some cases after not being used for a considerable time the pad may need moistening before use, which may be done with the sponge, and the surplus moisture removed as before.

The economy of this form of pad may be readily appreciated from the fact that whiting costs but about 2 cents per pound and glycerine 4 cents per ounce. A pad of the proper size for a note sheet requires 1¼ to 2 pounds of whiting. When worn away by repeated washings, so as to be too thin for convenient use, the remaining material may be added to the new.

OSCAR E. PERRIGO.

New Haven, Conn.

A Difficult Job of Stamping.

Editor American Machinist:

I have been very much interested in the articles relating to dies and die-making that have appeared in the "American Machinist" for some time past, and think that perhaps a description of the tools and method of making the stamping shown in the half-tones will be of interest to my fellow-craftsmen and readers of this valued paper. The outside diameter of the article is about 2.65 inches.

The orders on this job were, to produce a shell in which the thickness of metal throughout the entire stamping *must* be No. 12 Bir. gage, or .109 inch. An excess in thickness of the back of the stamping of .015 inch was finally allowed, as we had no press stiff enough to hold the metal to gage. The main difficulty encountered was to draw the small boss in the center without stretching the metal. After experimenting for some time with the usual method of drawing and redrawing, without success, we decided to launch out into new fields, and we accomplished the desired result in the following manner:

THE PIECE MADE.

The cutting of the blank, which is of No. 12 Bir. gage sheet steel, needs no comment, and is passed on to the second operation, shown in Fig. 1. This figure is a vertical section of die *B* and work *C*, and a partial axial section and elevation of punch *A*. The blank is placed in the recess at the top of die *B*, and punch *A* is brought down until the diameter of *C* is two or three thousandths of an inch less than the push-out *J*, Fig. 2. The depth of *C* must be sufficient to give stock enough to form the boss *b*, Fig. 3, after

the process of upsetting, the first operation of which is shown by *C*, Fig. 2, and the last one by Fig. 3. *A* and *B* are soft steel hardened in bone dust, are easily worked and give good satisfaction in a place like this.

Fig. 2 represents the punches and dies for performing the operation of "upsetting." *D* is the die-holder, and fits the ram of the press. *E* is a ring for holding the die F central against the face of *D*. *L* is the punch holder, recessed at the top, in which the "push-out" *J* slides. A hole bored in the bottom of this recess holds the punch *K*, secured by the screw *N*. This punch passes up through *J* and works in conjunction with *F*. *O* is the stem of some form of positive "knock-out," and, through *M*, actuates *J*.

This is a reversal of the usual order of things, and is necessary from the fact that if you put *C*, Fig. 2, through another "upsetting" operation, in dies made in the usual form, the metal in the boss "flows" out into the flange, and when you reach the last operation, the metal is "stretched," and of no use. By the method shown, *C*, Fig. 1, is placed on *J*, Fig. 2, convex side up; *F* is brought down, and as *C* is surrounded, the metal "flows" out into the flange in a slight degree only, and, with a press suitable for the job, is forced into the corner *a*, Fig. 2. There are five "upsetting" or redrawing operations, the dies and punches of which are interchangeable as regards fit in holders. Good material should be used in this set of dies, and a press of not less than 125 tons capacity. *D* should be hardened and ground on the face next to *F*, and should fit the ram of the press at both end and shoulder. The recess in *L* should also be hardened and ground.

Fig. 4 shows the punch that goes with Fig. 3. Fig. 5 illustrates the punch and

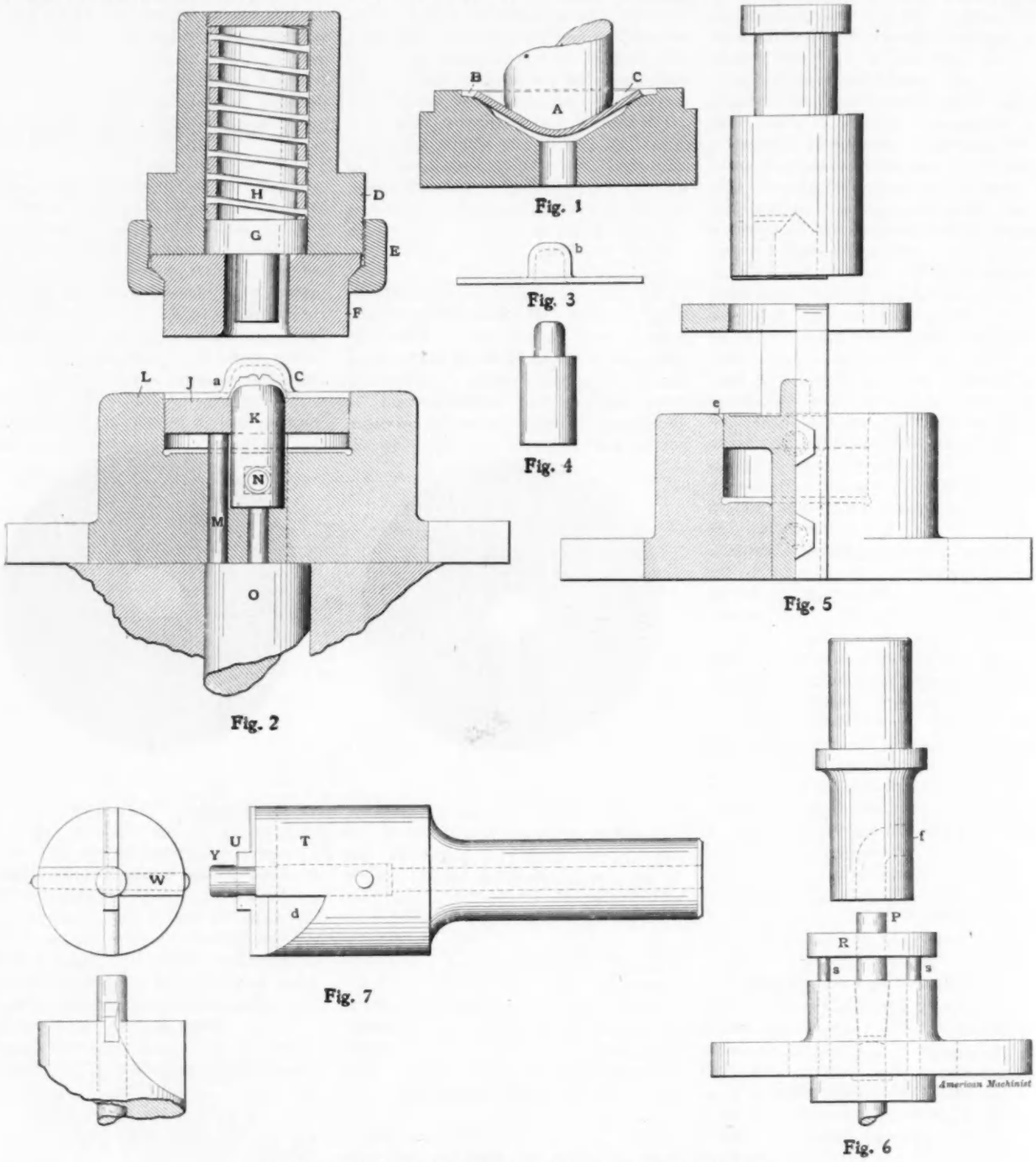


Fig. 1 Fig. 3 Fig. 4 Fig. 5 Fig. 2 Fig. 7 Fig. 6

SERIES OF PUNCHES AND DIES FOR DIFFICULT JOB OF DRAWING.

die for turning up the edge of the flange and embossing the back, as shown in the half-tone. The drawing is clear enough to need no description in regard to construction. We were obliged to put a head on the end of the punch to prevent its pulling out of the ram, as it "strips" very hard. The push-out in the die is kept from turning by a feather and spline, not shown. Nothing but a positive push-out motion will do on this operation. The stamping, as shown in Fig. 3, is placed over the pilot on the "push-out," and at one stroke the edge is turned up over the corner *c*, and the crank impression is made by forms on the end of the punch and in the "push-out."

In hardening the die it should be heated to a cherry red, suspended on a wire netting over a tub of water a distance from the surface of the water, depending on the capacity of the tub. A sheet metal sleeve to fit the outside of the die and standing four or five inches above the surface of it, should then be placed in position and a running stream of water turned on to the face of the die until the water in the tub submerges the entire die. In this manner you will, with a good grade of steel have a hard drawing surface, which should be polished in the direction of its axis.

Fig. 6 illustrates a die for piercing the end of the boss, and I think the construction is plain to all. The stamping is placed with the hole in the boss over the punch *P*, and after the stroke of press it is stripped by *R*, which is spring-actuated. *P* is made long enough to be ground on the face when dull. It should be used in an inclined press, unless the slot *f* is given a slant upward for the scrap to come out.

This finishes the press operation, and next comes the trimming of boss and rim. A tool for this operation is shown in Fig. 7. *T* is the body of the tool, turned down to fit the turret of a suitable machine, and is slotted across the opposite end, as shown, for the cutter. A hole the diameter of the inside of the boss of the stamping is bored partly through the body *T*, and a piece *V*, to act as a pilot and secure the cutter in place, is fitted into this hole a little snug. A slot suitable for the cutter is made in the pilot *V*; then *V* is tapped lightly with a mallet into *T* a little farther than required to hold cutter *U*, and a taper hole is made through both *T* and *V*. *V* is then taken out and made free in *T*. Then *V* and *U* are inserted into *T* and keyed in by the taper pin *W*. The body *T* is cut away at *d* for clearance for chips, and the cutter has a rake of 15 degrees.

E. E. MINARD.

Cleveland, Ohio.

A Peculiar Tap and a Freak Collar Button.

Editor American Machinist:

In the trades allied to the jewelry business occasional call is made for tools to fit altogether different conditions from the usual machine-shop practice. The main factor in this different order of things is, of course, the higher price of the materials, and scrap-saving devices are of more importance, as a general thing, than the reduction of time and labor usually sought in other shops.

The tap shown in Fig. 1 is one of these contrivances. It is intended to put a 36 thread through a 5-16 inch hole. The bushings tapped with it are, when finished, ½ inch long, and are the largest that we use in this class of work, most of the taps being for smaller bores and having correspondingly greater numbers of threads to the inch. The part at *a* is thinned down to 3-32 inch after being threaded in the usual manner, the diameter of the shank at *b* being somewhat less than the bottom of the thread. At *d* the teeth are given a radial face, and at *e* several teeth are brought down and backed off taper. The shank at *b* is cut away for half an inch, brazed on to the steel rod *c*, and then the tap is hardened and tempered. Although the tap is intended

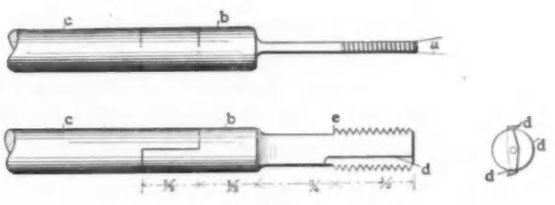


Fig. 1

Fig. 2

JEWELER'S TAP AND A BALL-BEARING COLLAR BUTTON.

to cut a right-hand thread, it is backed off and relieved as if it were left-handed, or, rather, is made to cut backward, the cutting teeth being at *e* instead of at the end. The rod *c* is usually 3 feet long. The tubing to be tapped (about the same length) is slid on to *c*, which is then gripped in the chuck of a speed lathe. On starting the lathe to run backward, the tube is drawn over the tap and off the rod. The tube is held from rotating by a few turns of overlapping belt lacing passed around it, one end of the lacing fastened to a file held in the hand. The tubing is then cut up in the desired lengths by a thin slitting saw, wax being used for a lubricant.

A few taps cut with three grooves did not work anywhere near so well; would not stand the speed and were apt to clog up with chips. I have talked the matter over with others who have had similar experience, and who pronounce this the best way of making a tap for this particular job—i. e., tapping drawn tubing in lengths.

This running a right-hand tap backwards reminds me of that (presumably) machine-shop fiction about the inventor who made a successful pump out of an unsuccessful rotary engine. It is to be hoped it is true, if only to prove how one may get the best of a very bad job. Be that as it may, an inventor came my way not long ago with a notion, and this inventor has made a unique application of a well-known mechanical device. The inventor's opinion of the thing it is unnecessary to quote. To put it mildly, he was enthusiastic; but I have not yet fully made up my mind whether the scheme will be a blessing or a curse.

Anyway, there it is in Fig. 2, a ball-bearing collar button. The ball *a*, about 5-32 inch diameter, is nicely beaded, with a burnishing tool, either in press or by hand, into the Belcher setting at *b*, and is free to turn loosely in any direction. I suppose an ordinary point setting (or claw setting used with diamond work) would do just as well if made heavy enough to retain the ball and not bind. Aside from the novelty of the thing, it is claimed that it can be pushed through the most obstinate shirt with an ease and readiness akin to the action of "greased lightning."

Have the fellows who have talked about the slippery collar button these many years, in prose and poetry, earned their money honestly or not? It is said that all men are liars, but have not the shirt-waisted folks chimed in with the aforesaid opinions; and what shall be said of an attempt, based upon an everyday mechanical device of known character, to increase these baleful qualities of the collar button that have caused so much annoyance?

R. I. CLEGG.

Providence, R. I.

Lathe Mandrels.

Editor American Machinist:

In the early history of our machine-shop practice the mandrel was very extensively used for turning and truing up a great variety of work, but on account of the manner of construction and the poor material of which it was made it was brought into bad repute, and for a number of years work that we thought could not be finished by other means has been produced along a

different line altogether. Where we used to bore the common iron pulley in one lathe and turn the rim in another we now have the special pulley lathe that will bore and turn at the same time. And, as in this case, so in many others, until the mandrel, as it used to exist, is almost a thing of the past. Of course, in the jobbing shop it will hardly disappear altogether, but will be transformed to such an extent that we shall hardly recognize it as the one important tool in the make-up of the older shops. In the first stages of its history, a piece of wrought iron with a center punch driven into the end satisfied the demand. In some cases the mandrel

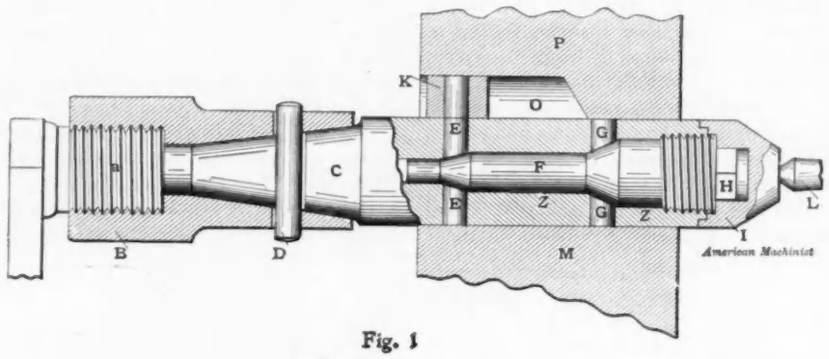


Fig. 1

A SPECIAL EXPANDING MANDREL.

was so large that it required a half-dozen men to handle it. This was turned down so many times for the job that was "just a trifle too small for it" that it finally got down to a respectable size. It was often a puzzle for a man to know what to do in the matter of the mandrel, as it would cost as much to fit one up ready for the job as to finish the work itself. This would not answer, as the customer would object to paying for it, and then the question would be who should stand the loss of time of the man hunting for the mandrel. He would often put in a piece of old shaft, 8 or 10 inches diameter, and finish a short section of it to turn up a collar 3 inches wide.

One of the first moves was to make the mandrel of cast iron, as it was easier to produce than the wrought iron and cost less. Then came the hollow mandrel, with a cross bar cast in the ends for centers. This was a great improvement, as it was much lighter and required less help to handle. But the driving in and out of the work ruined the centers, and it required truing up almost every time it was used. The next move was to drill into the end of the mandrel and drive in a hardened steel center, leaving the end below the surface of the end of the mandrel. This would hold its own and keep true for a longer period than anything that had been produced previous to it. The present practice is to make small mandrels, turn them up from a moderately high carbon steel, a little over the size, harden them all over and grind to a standard. This is all right for a shop that has a great number of pieces all just to size, but in a shop that does all kinds of work it is not always practicable.

Another device for prolonging the life of the mandrel is the press. It may be clamped to the lathe bed, and on small work two mandrels may be used. While one is in use in the lathe the operator can change the other.

Some years ago I devised the mandrel shown in Fig. 1 for heavy work, and found it very satisfactory, as the work could be put on and taken off without any driving or pressing. Then it could be trued up at any time, and would last indefinitely. First we fitted a hub-piece *B*, Fig. 1, to the spindle of the lathe, and bored the taper hole for the end of the mandrel *C*. This was keyed in with a hardened key D, having draft, so that it would always force the taper end up snug. Then we bored and reamed the

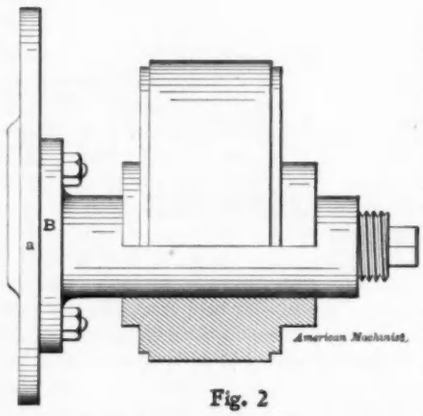


Fig. 2

SPECIAL MANDREL OR CHUCK FOR TURNING ECCENTRICS.

hole in the mandrel for the hardened steel pin *F*. The pins *E* and *G* may be set at thirds or quarters. They are also hardened and ground true on the outside. The pin *F* must be a good fit at *z z*, with a fine thread on the large end. *H* is a square for tightening. *I* is a cap fitted to the end of the mandrel and is supported by the tail center of the lathe. It also keeps the thread end of *F* free from grit and dirt. *M* represents a section of plain work, as a pulley-hub, gland, etc., and *P* shows a cylinder head, with *O* as the stuffing-box. In this case we use a ring *K* of cast iron, and a long steel pin *E* set out by the taper on *F*.

One size of this style of mandrel will answer for a great many different diameters, by having cast-iron rings to fit over it, similar to K. To remove a piece of work after it is finished, slack up the screw pin *F*, after removing the cap *I*, and the pins will be released, so that the work will be entirely free to be removed.

Fig. 2 shows this style of mandrel in use for turning eccentrics. It is made short and strong, so that it will stand up to the work. In the trials with this mandrel, we found that a 6-inch wrench on the square end *H* would tighten a cylinder head, 24 inches diameter, so that the heaviest cut on a 36-inch lathe would not start it in the least. In Fig. 2, the flange end *B* of the mandrel should be bolted to the lathe face-plate *a*, by bolts fitting reamed holes, to prevent changing the position of the mandrel and altering the throw of the eccentric.

H. S. Brown.

Easton, Pa.

"Crank Turning."

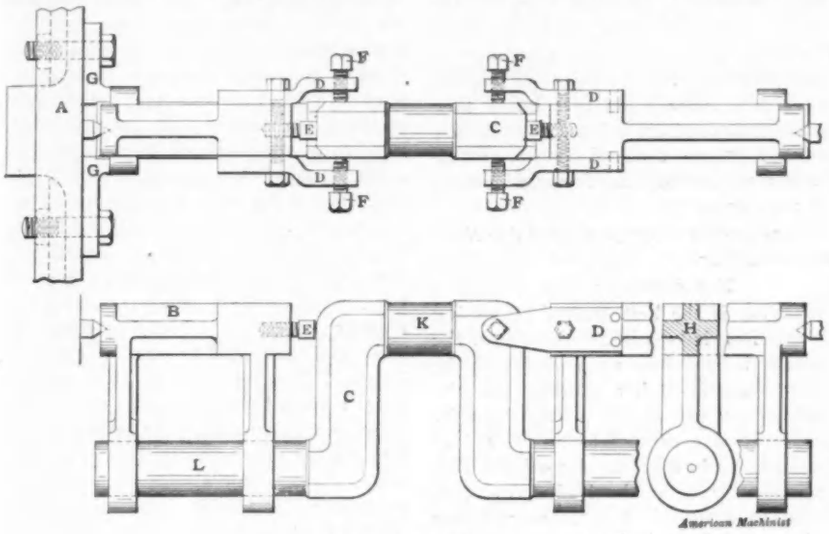
Editor American Machinist:

The accompanying sketch shows a rig for turning cranks, used with marked success on a number having a long throw in proportion to the size of the shaft. The castings *B* are bored to fit the straight turned part of shaft *L*, and centered for the lathe the same distance from the shaft center as the required length of the crank, which, if they are properly set, insures the turning of the crank wrist *K* parallel with the shaft. The straps *D* on the sides of casting *B* are for adjusting the side position of the crank by means of the set screws *F*, thereby making the adjustment a very simple operation. The screws *E* are for resisting the pressure of the lathe centers. This combination makes the whole quite rigid for the turning of the wrist *K*. The time necessary for perfect adjustment with this arrangement is too insignificant to make any account of. The center holes should be quite large, with three oil grooves cut in them to insure perfect lubrication. The casting *B* is square at *D*. The section of the arms is shown at *H*. *A* represents the face-plate of the lathe, with angles *G*, bolted on to lock and to drive the end of the shaft. The usual counterbalance, not shown, is bolted on to the opposite side of the plate.

The tools for such turning have to be as stiff as possible, on account of the reach from the tool-post to the cutting point. The roughing tool has a single small round point, and feeds both ways, and is set to cut at or below the center to prevent the digging-in, so liable to

occur in such cases. The finishing tools should be square-ended, with a small round for the corners, one to feed right hand, and one left; these also set at or below the center. By using soda water, a very fine finish can be made, without using file or emery cloth.

This rig would not pay unless there



A CRANK TURNING RIG.

were a considerable number to be made exactly alike. There are simple ways for centering arms clamped on the ends of a crank shaft, when only one is to be turned, which the wide-awake mechanic will use without having to guess and try again.

O. C. CRANE.

New York City.

The Solution of Right Angled Triangles.

Editor American Machinist:

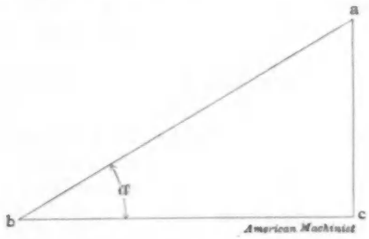
I note in your issue of June 22 the explanation of "Sines and Tangents," and it recalls many cases where inquiries for similar information have been made of us in the drafting room by men in the shop who have not had the benefit of a technical education. Even those who have had such an education do not always keep these matters freshly in mind, and are at a loss sometimes just what formula to use for a given problem. This was brought to my attention so forcibly soon after entering into practical work in the drafting room, that I compiled the following table for the use of those who had no knowledge of geometry or trigonometry, but who could use the tables of "natural sines" as given in the standard reference books, such as "Nystrom's Mechanics," provided they had the formulas in such form that they could use them.

By the use of the following table any right-angled triangle can be solved by those who know nothing of the whys and wherefores, but can follow the instructions given below.

To illustrate: In the following triangle let $b\,c$ and the angle α be given to find $b\,a$ the hypothenuse.

Looking in the table we find in the column "Parts given," in the next to the last line, "ang. and adj." That is, we have the angle α and its *adjacent* side $b\,c$ given. Following along on the same line, under "Parts to be found," to the column where formulas for finding the hypothenuse are given, we find "adj. ÷ cos." That is, the formula would be, the hypothenuse equals the *adjacent* side divided by the cos. of the angle α, or $b\,a = \frac{b\,c}{\cos.\ \alpha}$

The cos. of α can be taken direct from the table of cosines, so that it becomes a simple problem in division to obtain the answer.



PARTS GIVEN	PARTS TO BE FOUND				
	ANGLE	ADJ. SIDE	OPP. SIDE	HYPOTH.	OPP. ANG.
Op. and Hyp.	Sin. = $\frac{\text{OPP.}}{\text{HYP.}}$	$\sqrt{(\text{Hyp.}+\text{Op.})(\text{Hyp.}-\text{Op.})}$			Cos. = $\frac{\text{OPP.}}{\text{HYP.}}$
Op. and Adj.	Tan. = $\frac{\text{OPP.}}{\text{ADJ.}}$			$\sqrt{\text{Opp.}^2+\text{Adj.}^2}$	Cot. = $\frac{\text{OPP.}}{\text{ADJ.}}$
Adj. and Hyp.	Cos. = $\frac{\text{ADJ.}}{\text{HYP.}}$		$\sqrt{\text{Hyp.}^2-\text{Adj.}^2}$		Sin. = $\frac{\text{ADJ.}}{\text{HYP.}}$
Ang. and Op.		Opp. X Cot.		Opp. ÷ Sin.	90° —Ang.
Ang. and Adj.			Adj. X Tang.	Adj. ÷ Cos.	90° —Ang.
Ang. and Hyp.		Hyp. X Cos.	Hyp. X Sin.		90° —Ang.

SOLUTION OF TRIANGLES BY NATURAL LINES.

American Machinist

Taking the example illustrated by Fig. 3, in the article of June 22, we have the angle and the hypothenuse given to find the side opposite the angle α, which we find in the lower line of the table in the column headed "Opposite side," to be "hyp. × sin.," or the opposite side, $a\,c$ = the hypothenuse b a × sin. α.

If the sides $a\,b$ and $a\,c$ are given to find the angle B, then $a\,c$ becomes the *adjacent* side to the angle; and $a\,b$ being the hypothenuse, we find in the column "Angle," third line from the top,

$$\text{Cos.} = \frac{\text{adj.}}{\text{hyp.}}, \text{ or, cos. } B = \frac{a\,c}{a\,b}.$$

These points once understood, the table quickly gives the formula for any problem involving the sides and angles of a right-angled triangle.

The demand there has been for blueprint copies of this little table by the men at our works, shows that its value is appreciated, and leads me to think that it will be useful to the same class of men elsewhere.

L. D. BURLINGAME,
Chief Draftsman, Brown & Sharpe Manufacturing Company.

He Objects to the Irregular Curve.

Editor American Machinist:

I note that the irregular curve has been receiving attention in your columns of late, some interesting suggestions being made in regard to marking it to facilitate finding the right part for use in inking in.

Allow me to suggest that the best way to use this instrument is not to use it at all, as the difficulty does not end in the drawing room.

A drawing is not made merely to show how pretty and artistic the draftsman's conception is, but rather to enable the patternmaker and the other mechanics to execute it. Now a curve laid out with a scroll cannot be reproduced by any known tool used in the shop, while any circular curve can easily be made.

In my practice I have never permitted the use of anything but arcs of circles, which can be fitted together so as to approximate any of the regular geometric curves with a degree of exactitude sufficient for all practical purposes, and much greater than that obtained by the use of a scroll. By dimensioning the radii the curve is easily inked in and as easily reproduced in the shop, and the

shop is certainly the place to be considered.

What makes draftsmen hang on to such a poor botch instrument, is more than I can see. L. O. DANSE.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(71) "Gas Furnace," Birmingham, England, asks (1) for the best method of hardening and tempering long staybolt taps and reamers 36 inches and under in length by ¾ to 1½ inches diameter, so that when finished they may be perfectly straight and run true in the lathe centers. A.—We do not believe any method is known for doing this, and do not consider it practicably possible to do it. Various devices have been used for holding an article straight; that is, a sort of contrivance has been made with adjustable blades which have serrated edges and come in contact with the piece all along the sides so as to hold it straight. After being adjusted to the article the latter is taken out, heated and dropped into the holder, the holder, work and all, being then immersed. This, however, does not usually produce absolutely straight work, and where the work must be entirely straight we believe the only practical method is to heat it locally, after hardening, by some means, to a temperature not sufficiently high to draw the temper and then straighten by pressure while hot, and this can be readily done. (2) What is the best way to harden and temper shell taps 6 inches diameter, 9 inches long, with a hole through them 2½ inches diameter and keyway through one side ½ x ¾ inch, without fracture. A.—Perhaps there is no way of absolutely preventing fractures in such work as this, but the principal means is by absolutely even heating and by avoiding square corners in the keyway. The corner of the keyway, if it can be even slightly rounded will be much less liable to start a crack. (3) I use whale oil for hardening small tools. How can I overcome or get rid of the abominable odor. A.—A hood can be fixed over the vessel containing the whale oil and connected to a flue, which will carry off most of it. It would be better we believe, however, to use cotton seed oil, which would answer the purpose equally well and has no offensive smell.

(72) J. J. M., Ogden, Utah, says (1) With a pair of paper and iron friction wheels, the driving paper pulley being 10 inches diameter by 12 inches face, running at 200 revolutions per minute, and the iron driven pulley being 24 inches diameter, what horse-power will be transmitted if the pressure between the pulleys be 1,000 pounds? A.—Some very complete experiments were reported by Professor Goss in a paper read before the American Society of Mechanical Engineers, in 1896, from which the following formula was deduced:

$$\text{Horse-power} = .000238\ d\ w\ N.$$

in which

d = diameter of pulley in inches,
w = width of face in inches,
N = revolutions per minute.

This formula is for a pressure of 150 pounds per lineal inch of face, which Professor Goss considers allowable in good practice. The coefficient of friction is constant for all pressures below this, and as your pressure is but 83 pounds per inch, or 55 per cent. of that on which the formula is based, the formula becomes for your case:

$$\text{Horse-power} = .55 \times .000238\ d\ w\ N,$$

or substituting

$$\text{Horse-power} = 3+.$$

(2) What is the best method of cutting threads in a lathe without the use of the backing belt? A.—Lay a scale on the lathe shears in such a position that the carriage can run over it. Stop the lathe at the end of a cut and locate the end of the scale flush with the end of the carriage. Now open the lead screw nut, crank the carriage back to the nearest even inch beyond the end of the work, close the nut, and go ahead with the next cut. (3) How can I best temper indicator springs? A.—We have no personal acquaintance with the methods followed. (4) What force will be required to draw a car weighing 10 tons up a grade of 3 feet in 100 feet? A.—Measuring the length of track on the slope, the force necessary to overcome gravity alone is 3-100 of the weight of the car. To overcome the friction, Wellington's experiments show, for loaded cars on straight level track, a resistance of 5 pounds per ton of 2240 pounds at 10 miles per hour, and 7 pounds at 20 miles. Taking the latter figure the total resistance in your case would be $22{,}400 \times .03 + 10 \times 7 = 742$ pounds.

(73) G. C. G., Philadelphia, asks: (1) What is the best and quickest method to find the distance to set over the tail-stock on a lathe for turning tapers on heavy connecting rods, etc.? A.—On connecting rods the taper is usually not given as so much per foot as it is in other work, but simply the diameters of the rod at the smallest part and at the largest part are given in figures. If the cutting tool were to be set level with the centers, and if the smallest diameter and the largest diameter of the rod were at the extreme ends of the rod, then the tail center should be set over to just half the difference between the smaller and the larger diameters; but as the latter condition is not present, it is necessary to multiply half the difference between the smaller and the larger diameter by the ratio which the over-all length of the rod bears to the length of the tapered portion; which ratio is found, of course, by dividing the total length by the length of the tapered portion. For instance, suppose the rod is of the marine type, 6 feet long over all, and that its smallest diameter is 3 inches and largest diameter 6 inches, and that these two diameters are at points 4 feet 6 inches apart. Then the arithmetical solution will be as follows: $1.5'' \times \frac{72''}{54''} = 1.99''$ = distance to set over. This will give the distance to set over if the tool cuts level with the center, but it disregards the distance to which the centers enter the work. This, however, will not produce an error that will usually be appreciable in work of this kind. Where the taper is given at so much per foot, then half the difference in diameter in the work at any two points 1 foot apart multiplied by the length of the piece over all in feet will give the distance the tail-stock center is to set over, or one-half the difference in diameter at points 1 inch apart may be taken and multiplied by over-all length in inches. This, however, will not produce exact results, because the tool can seldom be set to turn precisely level with the center, and the centers enter the work a distance which is not usually accurately determinable. (2) We turn shafting 24 inches diameter by 26 feet long, and less, on an old 72-inch lathe. If we set tail-stock to turn the end bearing straight, when we come to turn the center fly-wheel bearing, it turns taper 1-16 to 3-16 inch in 4 feet. Can you give me a more rapid method to find the distance to set over to make the lathe turn straight than by moving the carriage back and forward? A.—We know of no quicker or better method than to turn two spots on the shaft at the extreme ends of the bearing or place to be turned. Make these spots of the same diameter, and then set the tail-stock over until the tool will touch both these spots when the cross-feed handle is in the same position. This can be determined by making a mark on the collar of the cross-feed screw. If desired a piece of paper or a thin wedge may be used between the tool and work to determine parallelism. (3) Can you give a good, practical rule for fitting cylinder heads from 20 to 60 inches diameter—that is, how much larger should such heads be turned than the bore of the cylinder to guarantee a neat force fit? A.—It is not the practice to force cylinder heads in tight. They are merely made to fit closely, but are not the kind of fit usually understood by a force fit. The latter is one that must be driven or pressed in by hydraulic pressure. Cylinder heads are usually made simply close enough, so that they will not have play, but will fit without shake, and for this purpose it is the practice to make the cylinder head as nearly the same size as the counter-bore as possible. Of course, different men use the caliper in different ways; but it has been the practice of the writer to simply make the two pieces in such a case as nearly the same size as possible, using the caliper with a very light contact.

Foreign News Notes.

The great Siberian railway has been completed as far as Irkutsk, on Lake Baikal, and as an immediate result the importation of machinery and plants of all kinds to be used in the Russian mines has increased greatly. All mining material is imported free of duty, and as Russia is intent upon the opening up of new gold, iron and coal mines, it will easily be seen what a good field is now opening up. Already we have received some orders from St. Petersburg for mining machinery, and there will be many more that we may have if we only watch closely for opportunities.

At the present time there are 3,300 miles of railway completed in Japan, and new ones are now under contemplation.

Our English cousins are calling attention to the commercial headquarters which we maintain in Buenos Ayres, where there can always be found on exhibition various kinds of agricultural implements and machinery of every description. They are quite ready to acknowledge the advantage that we have by reason of these sample rooms.

During the year 1898 Russia imported from British manufacturers steam engines and machinery to the value of $6,974,100. of which sum $6,021,282 was for textile machinery alone. A review of our own trade for the same period shows a total exportation of all kinds of machinery to Russia amounting to $1,165,927. Of that amount $425,587 was for agricultural implements, $174,728 for pumps and pumping machinery, $483,510 for locomotive engines, $9,565 for stationary e. gines and $72,537 for boilers.

The Osaka Iron Works, of Osaka, Japan, have decided to enlarge the scope of their business, and to that end they will build a yard for the building of steamers having a capacity of 2,500 tons each. During the past year that yard constructed eight small vessels, and eight more are under construction. A. F. T.

A New Motor Carriage.

A motor carriage has been brought out by the well-known bicycle firm of E. C. Stearns & Co., of Syracuse, N. Y. The power equipment is electricity, consisting of secondary battery and a specially designed motor, and series parallel controller, giving three speeds forward and back. The performance of the carriage is very satisfactory.

In appearance the design is decidedly unique and pleasing, being of the single seated run-about type, with side bars and cross body springs; wire wheels with three inch pneumatic tires of 32 and 36 inches diameter, respectively, being used No stock parts were used whatever, all the details being specially designed and built in the shops of the company. The electric details were looked after by Mr. C. E. F. Ahlm. The complete carriage was designed and built by Mr. Frank Carey, who will be remembered by our readers as the designer and builder of the unique engine illustrated and described in our issue of January 30, 1896. The machine proves itself a success and credit to its builders, as no failure or weakness of parts has developed during a series of severe trial runs.

Mechanical Draftsman, Ordnance Department.

The United States Civil Service Commission announces that on October 3, 4 and 5, 1899, examination may be taken at any city in the United States where it has a board of examiners for the position of mechanical draftsman, Ordnance Department (Navy Department).

From the eligibles resulting from this examination certification will be made to fill the position of mechanical draftsman, Ordnance Department (Navy Department), Mare Island (Cal.) Navy Yard at a salary of $4 per diem. This examination is open to all citizens of the United States who comply with the requirements. All such citizens are invited to apply. They will be examined, graded and certified with entire impartiality and wholly without regard to any consideration save their ability as shown by the grade attained by them in the examination. Persons desiring to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application blanks (Forms 304 and 375), which should be properly executed and promptly forwarded to the Commission at Washington, D. C.

Assistant Draftsman, Ordnance Department.

The United States Civil Service Commission announces that on September 5 and 6, 1899, examination may be taken at any city in the United States where it has a board of examiners for the position of assistant draftsman, Ordnance Service.

From the eligibles resulting from this examination certification will be made to fill the position of assistant draftsman, Ordnance Department, Washington Navy Yard, Washington, D. C., at a salary of $772 per annum.

Persons desiring to compete should apply to the United States Civil Service Commission, Washington, D. C., for application blanks (forms 304 and 375).

Personal.

Francis C. Pratt, foreign sales manager for the Pratt & Whitney Company, of Hartford, Conn., recently returned home from a trip abroad.

Mr. George Clark has resigned his position as Superintendent of Construction for the Newport News Shipbuilding & Dry-Dock Co., and has accepted a similar position with the Cramp & Sons Ship & Engine Building Co., of Philadelphia, Pa.

James Entwistle, fleet-engineer with Admiral Dewey's squadron, on the Olympia during the Manila battle, recently received a commission as Captain, and now has been retired under the provisions of the personnel bill, with rank and three-quarters of the sea pay of a rear-admiral.

Our contributor, J. E. Johnson, Jr., until recently engineer and assistant manager of the Longdale Iron Company, at Longdale, Va., has been appointed superintendent of the Alabama Coal and Iron Company, of Gadsden, Ala., and will enter upon the duties of his new position immediately.

Obituary.

L. W. Serrell, who was one of the best known and also one of the most competent patent lawyers, died at his home in Plainfield, N. J., on the 1st inst. Mr. Serrell was born in London, England, in 1829. He served in the Civil War as first lieutenant of Company E, 13th New Jersey Volunteers.

We learn of the death on July 15 of Mr. Hugh C. Robinson, of Monmouth, Ill. He was among the earliest subscribers to and readers of the "American Machinist," and enjoyed the reputation of being an excellent mechanic and citizen, Mr. Robinson was born in Nicholas County, Ky., in 1824.

Henry Simon, of the firm of Henry Simon, Ltd., Manchester, England, died

(*Continued on page 40.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Patents. W.E.Willis,Sec.W.Bourse,Phila.,Pa.

Cam cutting. F.J.Stokes Mach.Co.,Phila.,Pa.

Tool-maker's bench lathe, A1, new; one-third cost. Box 186, AMERICAN MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

Index drilling, notching dividing plates and dial graduating. The Arthur Co. See page 41.

Agents wanted; $500 given in prizes to hustlers; booklet free. A. Byer Tool Co., Chambersburg, Pa.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Will sell automatic, self-opening die; thoroughly tested; patents pending. Address Box 172, AMERICAN MACHINIST.

Wanted—Second-hand No. 0 Pratt & Whitned hand screw machine, with automatic wire feed. Address Box 182, AMER. MACHINIST.

For Sale, at a Bargain—One new 3-spindle sensitive drill press; Woodward & Rogers pat. The Cooke Mach. Co., 110 Liberty st., N. Y.

For Sale, Cheap—Second-hand 10 in. Gould & Eberhardt shaper. Wheeler Condenser & Engineering Co., 120 Liberty st., New York City.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without

(*Continued from page 39.*)

on the 22d ultimo. He was born in Brieg, Silesia, in 1835. When nineteen years old he entered the University of Breslau, and subsequently entered the Swiss Federal Technical College at Zurich. He was best known, perhaps, for his inventions in connection with flour milling machinery, he having invented the roller milling system, now used in almost all civilized countries. Mr. Simon was a member of the Institution of Mechanical Engineers, the Society of Engineers and Architects of Austria, and a fellow of the Royal Geographical Society.

Technical Publication.

We have received from the educational department of the Young Men's Christian Association copies of their Annual Report for 1899, giving an account of the educational work accomplished among young men by means of evening classes and day schools. The total enrollment of students for the season was 27,400. The work in connection with the electrical and mechanical course is especially gratifying, and those in charge of it are greatly encouraged. In the mechanical drawing course a very large increase in the number of those who have taken it up is noted. We have received also the Prospectus for the season of 1899-1900, which contains outline courses of study, regulations for examinations and such other information as is likely to be of service to any who may be contemplating taking advantage of the various classes.

Jas. Clark, Jr. & Co., Louisville, Ky., are making an electrically driven power hack saw, which has the motor completely inclosed within the housing, where it cannot be injured by dirt or by anything getting into it, and the starting switch is also inclosed. The saw feeds by gravity, and an automatic stop releases the switch when the work is cut, and this stops the motor. The machine is very neat in appearance, and is designed for 12-inch saw blades, to cut off stock up to 4½ inches diameter.

The Acme Machinery Co., of Cleveland, Ohio, have brought out a smaller size of their well-known heading and forging machines, which is called the ¾-inch machine. This differs from the previous ones (which have been illustrated in our columns) by having its fly-wheel keyed fast to the crank shaft and in having a cast steel instead of a gray iron frame. Some minor changes have been made also in the arrangement of the parts especially adapting it to the higher speed at which this smaller machine is run. On a test of the first machine of this design built, it was driven at 75 revolutions per minute, and at each revolution made complete a half-inch button-head bolt with short square under the head.

Miscellaneous Wants—Cont'd.

algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

For Sale—Two 12-inch by 5-foot bed engine lathes (new), 1-inch hole through live spindle, complete, with gears, etc. Apply to G. W. Francis, Reading, Pa.

Gear and milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

Have a first-class agricultural machine, just patented, partly introduced, with good success and prospect, and have in view a very suitable for sale machine works; capital wanted to push same. J. M. K., Box 6, Maria Stein, O.

Machine and boiler shop for sale, in a town of 10,000 inhabitants; natural gas; good location for man with moderate capital; reason for selling, age. Address Box 175, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Mechanical engineer and draftsman is open for engagement. Box 180, AMER. MACHINIST.

Draftsman, mechanical, for New York, wants position. Box 184, AMER. MACHINIST.

Tool and die-maker on any metal; large experience. A. X. Geisler, 70 Elm st., Newark, N. J.

Situation wanted as representative abroad, to sell American machinery, by experienced German-American. Box 183, AM. MACHINIST.

Inventor wants position as foreman or experimentor; first-class machinist; best of references. Box 169, AMERICAN MACHINIST.

Position as foreman wanted, by machinist and tool-maker, up to date in methods of doing work at reduced cost. Address Box 190, AMERICAN MACHINIST.

Draftsman, designer, technical graduate, 12 years' experience special machinery, 5 on shoe machines, desires change. "Swede 36," care AMERICAN MACHINIST.

Wanted—By thorough, practical and inventive machinist, position as demonstrator in technical school or foreman in modern shop; highest reference. Box 170, AM. MACH.

Situation as foreman, by a first-class toolmaker; 20 years' experience as foreman and tool-maker in sheet-metal factories and on interchangeable machinery. Box 181, AMERICAN MACHINIST.

I don't know it all, but 18 years in machine shop, pattern shop and drafting room have taught me that there are others. If you want a superintendent, write to me. Box 155, AMERICAN MACHINIST.

Wanted—Position as manager or superintendent; 20 years' experience in designing, constructing and managing, mechanical and electrical manufacturing; best N. Y. references. Address Box 173, AMER. MACHINIST.

Wanted—A position as general foreman or superintendent of a factory; have had a technical education and extensive experience in designing and building agricultural and general machinery; preference Chicago vicinity. Box 174, AMERICAN MACHINIST.

Efficient man of thorough experience in developing trade and managing successful manufacturing business, wants to place services with factory promising good results from hard work; moderate salary; gilt-edged references. "Integrity," AMERICAN MACHINIST.

Position wanted by a mechanical expert, experienced in machine-shop and drawing-room practice; has been especially successful in developing inventors' ideas, and designing automatic machinery; New York or Brooklyn only. Address Box 128, AMER. MACH.

Foreman or superintendent desires to negotiate with parties in need of a first-class man, one who has had a large experience on high-grade engines; present position 9 years; would like to invest some capital with good concern. Box 179, AMERICAN MACHINIST.

American mechanical engineer, technical graduate, with up-to-date, practical experience, and at present holding responsible position in Europe, desires change; could be useful in connection with Paris Exposition. Full particulars and best of references given on application to Box 189, AMER. MACHINIST.

Position as foreman, by a practical, up-to-date pattern-maker of 14 years' experience; skilled in all branches of his trade; able to direct and handle men to good advantage; American; strictly temperate; non-union, and not afraid to do an honest day's work. For other information address Box 171, AMERICAN MACHINIST.

Mechanical engineer, graduate, experience 15 years, high-grade ability as designer and executive, advanced methods for duplication of interchangeable parts, thorough knowledge of textile machinery, including operating experience, wishes position as superintendent or head draftsman with large concern. Box 187, AMERICAN MACHINIST.

An experienced, middle-aged mechanical engineer, recently returned from Europe, seeks position of master mechanic or works manager; large and varied practice in machinery and up-to-date shop methods; expert draftsman; good executive and business ability and correspondent; excellent testimonials. Address Box 144, AMERICAN MACHINIST.

Help Wanted.

Wanted—First-class pattern maker on valve work. Address Box 178, AMER. MACHINIST.

Pattern makers wanted at once. Apply at The De La Vergne Refrigerating Machine Co., foot E. 138th st., New York City.

A salesman to sell machinery in Europe; must be a practical mechanic, speak German or French, and thoroughly understand his business. Address Box 188, AMER. MACH.

Wanted—Superintendent for large jobbing brass foundry making large and small castings; must be able to handle men and metal economically; give experience. Address Box 166, AMERICAN MACHINIST.

Wanted—General machine-shop foreman for old-established company, manufacturing staple line of machine tools; one having $5,000 can become interested and secure position. Box 185, AMERICAN MACHINIST.

Competent machinist as assistant superin-

"Paid for Itself in One Month."

"TOLEDO, OHIO, July 10, 1899.
The Burt Mfg. Co., Akron, O
Gentlemen—Yours of the 7th inst. at hand. Must say that it paid for itself in one month. Would not be without it.
GENDRON WHEEL CO."

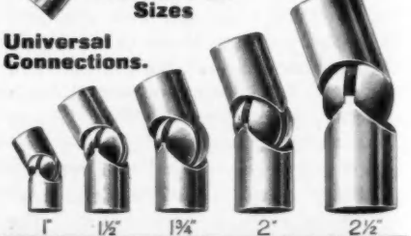
Shall we send you a **CROSS OIL FILTER** on 30 days trial?
Send for booklet.

THE BURT MFG. CO.,
AKRON, OHIO, U.S.A.
Largest manufacturers of Oil Filters in the world.

Vanderbeek Tool Works
HARTFORD, CONN., U. S. A.

We make all Sizes

Universal Connections.



tendent in a factory near Philadelphia, to oversee tool-makers and make estimates on light contract work; state age, experience, references and wages required. Box 157, AMERICAN MACHINIST.

Draftsman wanted; should be technically proficient, ambitious, and with at least 2 years' practical drafting-room experience; line, high-class automatic, sheet-metal and wire-working machinery. Address "Permanent," care AMERICAN MACHINIST.

Wanted—A good mechanic who is familiar with tool and die-making, up to date; also some knowledge of electricity and electroplating; to the right man a permanent and good paying position is waiting. Address Box 177, AMERICAN MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite applications from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Several first-class and experienced mechanical draftsmen who have some ingenuity and are capable of laying out and finishing their work; position permanent; salary according to ability. Address E. H. Dyer & Co., 705 New England Building, Cleveland, O.

A large manufacturing corporation with ample capital desire the services of a competent man who thoroughly understands the manufacture of automobiles, both motors and carriages, in all their details; applicants will state their experience, qualifications, age, etc. "Automobile," Box 176, AMER. MACHINIST.

Wanted—Draftsman and assistant, in Philadelphia; experienced in designing machine tools, hydraulic and general machinery; permanent position and advancement for the right man; state if graduate in engineering, age, experience, references and salary expected. Address Box 130, AMER. MACHINIST.

Wanted—A thoroughly experienced man, capable of taking the superintendency of an agricultural implement factory; must be of good character and habits, a first-class mechanic and organizer, well recommended. Address, giving full information as to above requirements, giving age and stating whether married or single, Lock Box 309, Jackson, Mich.

FOR SALE.

Valuable Special Tool.

United States Patents No. 535,127, Special Tools, Stock, etc., for

S. M. Balzer's new tool for backing off Milling Cutters. Awarded the John Scott Legacy Premium and Medal, by the Franklin Institute, Philadelphia, Pa. Of this tool, the AMERICAN MACHINIST in its issue of May 30, 1895, says:

"Mr. Balzer's device we believe to be one of the few really new things in Mechanics."

STEPHEN M. BALZER,
No. 370 Gerard Avenue, NEW YORK, N. Y.

Needs No Special Drills Or Taps.

Want One On Trial?

We gladly send our Fulmer Tapping Attachment on trial, because after its value has been demonstrated in your shop you'll want to keep it. Taps holes, either through or bottom, without reversing or stopping machine. Tools changed with perfect safety while spindle rotates. When tapping, to reverse, take hold of the handles and it comes up with quick return.

Send for circular and price list.

THE UNION TIRE CO., Plainfield, N. J.

CLEVELAND GEAR WORKS,
W. R. SAWYER, Lessee.
88 SENECA STREET, CLEVELAND.

GEARS of all descriptions

Whitcomb Planers,
WHITCOMB MFG. CO.,
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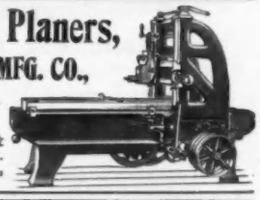

Selig, Sonnenthal & Co., London. G. Diechmann & Sohn, Berlin, C, 22.

The Eddy System.

The Eddy System of equipping Machine Shops with Electric Power is not "the coming system"—it's the system that has already arrived.

Send for a list of some of the big and successful concerns who are our customers, and for other interesting and profitable information.

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New York: Singer Bldg., 149 Broadway. Chicago: Marquette Bldg. Cable address: Dynamo, Windsor.

Special Screws and Studs.
Sheet Metal Stamping.
Hardware Specialties.
SITTMAN & PITT,
STATE STREET AND BOERUM PLACE, BROOKLYN, N. Y.

HENRY CAREY BAIRD & CO.,
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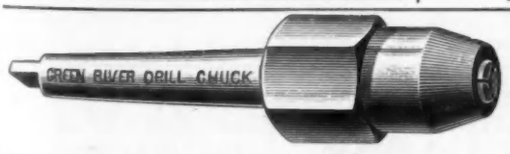
GEARS.

We cut 6 ft. in diameter down to the smallest clock pinion

The Arthur Company,
186 Front St., New York.



The Green River Drill Chuck

is a good Chuck to use where an accurate and strong holding Chuck is required for nice work. Grips and centers perfectly. Made in two sizes and three styles of shanks, and for each size of drill a spring bushing of best tool steel, with jaws carefully hardened and tempered, is furnished. Write for our 204-page book, which fully describes our entire line of patent screw-cutting and other labor-saving machinery and tools.

WILEY & RUSSELL MFG. CO., Greenfield, Mass., U.S.A.
Selig, Sonnenthal & Co., 85 Queen Victoria St., London, England.

The second annual meeting of the American Section of the International Association for Testing Materials will be held at Pittsburgh, Tuesday and Wednesday, August 15 and 16, 1899. The sessions will be held in the rooms of the Engineers' Society of Western Pennsylvania, 410 Penn Ave. Those desirous of obtaining full information can do so by addressing Richard L. Humphrey, Society of the American Section Testing Laboratory, City Hall, Philadelphia.

The National Association of Gas and Gasoline Engine Manufacturers met in Detroit for their first convention on the 2d inst. S. E. Baker, Springfield, Ohio, was elected president; R. G. Weber, Kansas City, vice-president; A. S. Rodgers, Springfield, Ohio, secretary, and C. D. Dudgeus, Columbus, Ohio, treasurer. It will hold its next meeting in Chicago on the first Wednesday in November.

The success of the air-power cars on Twenty-eighth and Twenty-ninth streets, New York, has caused the Metropolitan Street Railway Company to adopt them permanently for that route.

Manufacturers.

The National Malleable Casting Company, Indianapolis, Ind., is to erect a new brick foundry, to cost $8,000.

The Cloremus Machine Company, of New York and Washington, with a capital of $100,000, was chartered at Dover, Del., recently.

The E. A. Henry Wire Company has been formed to erect a plant at Cuyahoga Falls, Ohio. The capital stock is $20,000, but it will be increased.

We have been informed that De Fries & Co., dealers in American machine tools, of Berlin, Germany, have been recently incorporated with a capital of 1,500,000 marks ($375,000).

E. A. & S. A. Allen, Westfield, Mass., are to build another factory building east of their present property near the Westfield river, and it will be of wood, 30 by 88 feet, and two stories high.

Frank Forsythe has been awarded the contract to build the new factory of Henry M. Weimer at Langhorne, Pa. It will be 40 by 60 feet, three stories in hight, constructed of brick and iron, and cost $6,000.

It is reported that the Yale & Towne Manufacturing Company, lock manufacturers, with factories at Stamford and Branford, Conn., may move their plants to some town in New Jersey, within easy reach of New York city.

The Wyoming Valley Lace Manufacturing Company, of Wilkesbarre, Pa., intend making improvements to their plant. It is to be brick and iron, with cement and pine floorings, having usual factory conveniences and office fixtures.

The Riverside Manufacturing Company, Utica, N. Y., is erecting an addition to its plant. The addition will be 39x54 feet, and will be three stories high. As soon as the company has the use of this room twice as many hands will be employed as at present.

Plans are now completed for a new silk mill to be built at Stirling, N. J., and work will be begun soon. The mill is to be built for H. A. Streuli, the owner of the silk mill

already in operation here, and is to meet the demand which the other mill cannot handle satisfactorily.

Frederick M. Weller has been awarded the contract for a factory for the Delaney & Whitman Company, at Front and Richmond streets, Philadelphia, Pa. The structure will be four stories in hight, size 64 by 160 feet, with a boiler and engine building. Estimated cost, $16,000.

The Enterprise Manufacturing Company, of Third and Dauphin streets, Philadelphia, Pa., will make extensive alterations and additions to the property at above address, and estimates for the same will be taken immediately. A new granite front and brick addition will be constructed at a cost of $5,000.

George Kessler is to do $6,500 worth of work at R. H. Foerderer's plant, on the north side of the Pennsylvania Railroad, above Wheatsheaf lane, Philadelphia, Pa. The work will consist of the erection of a two-story factory addition, 36x80 feet, and adding a third story to the present factory building.

There is promise that Minneapolis capitalists, among them W. D. Douglass, G. F. Piper and R. F. Brett, will soon build a big linseed oil mill, the cost to be in the neighborhood of $225,000. The plant will be located at Midway. The mill will consume from 2,500,000 bushels to 3,000,000 bushels of flax annually.

Messrs. Fritz & Krouse, of Royersford, Pa., who operate the Royersford Knitting Mills, intend removing their entire plant to Pottstown, Pa., and erecting suitable buildings. A new brick and iron factory building, thoroughly equipped and containing latest improvements in power apparatus will be constructed.

In an interview recently Mr. Hugh Ramsey, of Perth Amboy, N. J., is reported as saying that a syndicate desired to purchase the shipbuilding plant at the above named place, and of which he is proprietor. He said also that it was the purpose of the syndicate to establish a shipbuilding plant of considerable size.

The Stirling Boiler Company are making the following additions to their plant at Barberton, O., viz.: 60x100 feet to the foundry; a machine and erecting shop, 60x182 feet, for the marine boiler department; a plate and stock shed, 60x160 feet; an extension to the boiler shop, 80x80 feet; a tube-bending shop, 30x50 feet.

The Western Electric Company will erect a new ten-story factory at the northwest corner of Washington and Bank streets, New York, N. Y. Plans have been submitted to the Building Department through Architect Cyrus L. W. Eidlitz, and call for a brick and terra-cotta structure on a plot 105 by 140. The new building will cost, according to the present estimate, $450,000.

Contractor George C. Dietrich, Philadelphia, Pa., has taken out permits for extensive improvements at the Midvale Company's plant, on the north side of Nicetown lane and the Reading Railroad, to cost $29,000. The work will include the construction of a one-story extension, 60x112 feet, to the machine shop; two-story extension, 30x60 feet, to the stove building; one-story extension, 50x135 feet, to the casting department; one-story extension, 30x70 feet, to the machine shop, and seven one-story toilet rooms, 15x58 feet.

The Riter-Conley Manufacturing Company, of Preble avenue, Allegheny, Pa., has taken out building permits at the Allegheny Bureau of Building Inspection for new buildings which aggregate in value $69,000. The buildings to be erected are as follows: Structural department, 110x418 feet, of structural iron and stone, cost $55,000; power building, brick, 40x165 feet, cost $6,000; store build-

(Continued on page 43.)

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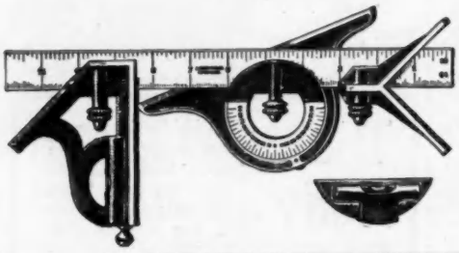

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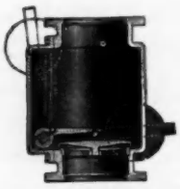

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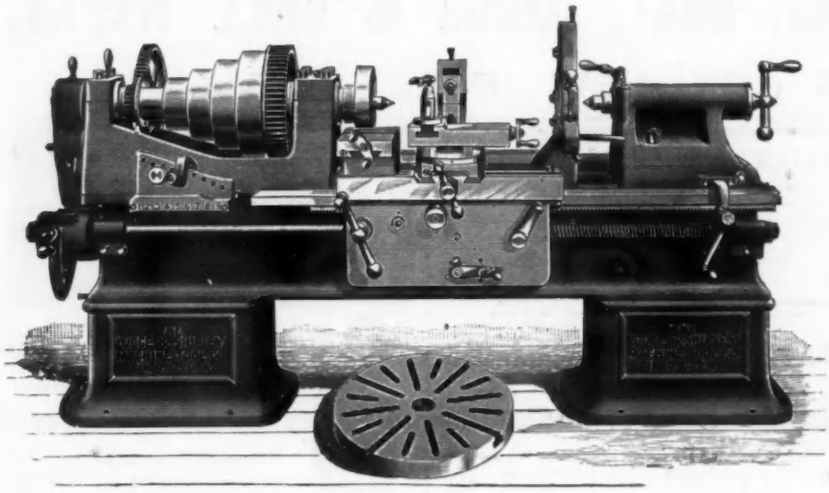

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(*Continued from page* 42.)

ing, 31x138 feet, three stories, structural iron, $8,000. All these buildings are to be erected on the site of the buildings destroyed by fire a few weeks ago.

The Commonwealth Electric Company, Chicago, Ill., is to erect, this summer a building to accommodate the increased electric light and power business. The new building will be placed beside the old one in Fifty-sixth street, near Wallace, and in time other new ones will take the place of those now in use. It is expected to have the new plant in operation in the fall. The building is to be 113x 121 feet and 65 feet high. Pressed brick and stone will be the materials, and the foundations will be made especially strong for the heavy machinery. The cost of the building will be $100,000 and as much more will be used in equipping it with dynamos and engines.

New Catalogs.

We are in receipt of Bulletin No. 29, issued by the University of Wisconsin, which is a special announcement relating to the College of Mechanics and Engineering. Full particulars of the facilities and equipment of the college are given, together with the requirements for admission and the courses of study.

Westinghouse, Church, Kerr & Co., New York, have issued a tastefully gotten up booklet entitled "Light and Power Installations for Private Residences and Hotels." The booklet contains illustrations of a number of well-known residences where electric lighting is provided by Westinghouse gas engines and generators. It is 6½x7 inches.

Boston (Mass.) Gear Works sends us 1899 catalog of gears of practically all kinds, pinion wire, racks, steel balls, sprockets and chains and similar articles. The catalog is gotten up in such a way as to give a very clear idea of the functions of the machines advertised, and it also contains a number of useful suggestions on gears. It is 5x8 inches.

F. H. Bultman & Co., Cleveland, Ohio, sends us catalog describing and illustrating the "Superior" automatic gear cutters. The various features of these machines are fully described, and in addition to a number of testimonial letters some useful hints on gear cutting, together with tables to be used in such work, are included. The catalog is 4½x6½ inches.

Holden & Brooke, Limited, West Gorton, Manchester, England, send us illustrated catalog of the "Sirius" pulsating pump, especially adapted for the raising of water from excavations of all descriptions, filling or emptying tanks, vats, etc., discharging bilge and acting as an emergency pump on board ship. The various points of interest of the pump are clearly described. The catalog is 5¼x8 inches.

The Webster Manufacturing Company, Chicago, sends us copy of their power-transmission catalog containing very complete descriptions of all kinds of power-transmitting appliances, such as shafting, hangers, rope sheaves, pulleys, shaft couplings, etc., etc. The catalog contains 200 4½x6¾-inch pages, and should be of interest to those engaged in the installation and maintenance of power-transmission machinery.

From the Jos. Dixon Crucible Company, Jersey City, N. J., we have received pamphlet entitled "Brazing by Immersion," which has been reprinted from the "Cycle Age." This contains a very complete and interesting account of liquid brazing as carried on in bicycle manufacture. The article is profusely illustrated, and to those interested in this class of work the pamphlet should be of decided value.

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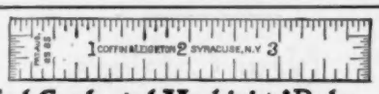

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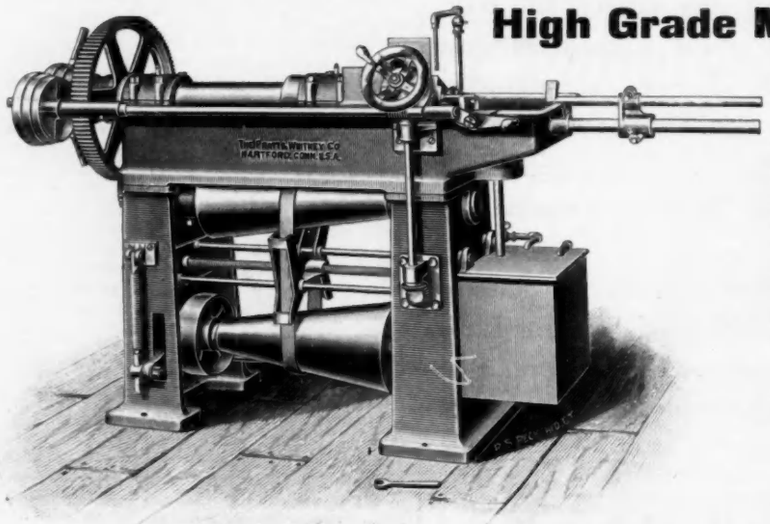

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